STANLEY Assembly Technologies

Alpha Controller User Manual

Software Version QA1-3.4.1

Important Safeguards

For your protection, please read these instructions completely, and keep this manual for future reference. Carefully observe and comply with all warnings, cautions and instructions placed on the equipment or described in this manual.

www.StanleyAssembly.com

Contents

Getting Started

This manual is intended to promote proper and safe use and give guidance to owners, employers, supervisors, and others responsible for training and safe use by operators and maintainers. Please contact your Stanley Sales Engineer for further information or assistance on Stanley training or assembly tool operations.

1.1 EC Directives

The QPM tightening systems are designed and built, in whole or in part, using the following standards and or directives.

2006/42/EC Machinery Directive

Standard	Title/Description
EN292-1,2	*Safety of Machinery - Basic Concepts*
EN14121-1	*Safety of Machinery - Principles of Risk Assessment*
EN50178	*Electronic Equipment for Use in Power Installations*
EN60204-1	*Safety of Machinery, Part 1 - Electrical Equipment of Machines*
EN60745-1	*Hand-Held Motor-Operated Electric Tools - Safety*

89/336/EEC Electromagnetic Compatibility Directive

Standard	Title/Description
EN55011	*Conducted and Radiated Emissions*
EN61000-3-2	*Current Harmonics*
EN61000-3-3	*Voltage Fluctuation and Flicker*
EN61000-4-3	*Radiated Immunity*
EN61000-4-4	*Fast Burst Transients*
EN61000-4-5	*Surge*
EN61000-4-6	*Conducted Immunity*
EN61000-4-8	*Magnetic Immunity*
EN61000-4-11	*Voltage dips/interruptions*
EN61000-4-2	*Electrostatic Discharge Immunity* *Level 4: Contact Discharge 8 KV, Air Discharge 15 KV*

1.2 Warnings and Cautions

The safety notices and warnings for protection against loss of life (the users or service personnel) or for the protection against damage to property are highlighted in this document by the terms and pictograms defined here. The terms used in this document and marked on the equipment itself have the following significance:

Danger — Indicates that death or severe personal injury will result if proper precautions are not taken.

Indicates a general hazard. This icon appears as a part of a Danger, Warning, or Caution notice.

Warning — Indicates that death or severe personal injury **may** result if proper precautions are not taken.

Indicates that eye protection should be worn. This icon appears as a part of a Danger, Warning, or Caution notice.

Caution — Indicates that property damage may result if proper precautions are not taken.

Read and understand all the safety recommendations and all operating instructions before operating tools and controllers.

Indicates an electrical hazard. This icon appears as a part of a Danger, Warning, or Caution notice.

Indicates an item of special interest.

WARNING

To Avoid Injury:

- Read and understand all the safety recommendations and all operating instructions before operating tools and controllers. Save these instructions for future reference.
- Train all operators in the safe and proper use of power tools. Operators should report any unsafe condition to their supervisor.
- Follow all safety recommendations in the manual that apply to the tools being used and the nature of the work being performed.
- Verify that all warning labels illustrated in this manual are readable. Replacement labels are available at no additional cost from **STANLEY ASSEMBLY TECHNOLOGIES**.

Qualified Personnel

WARNING

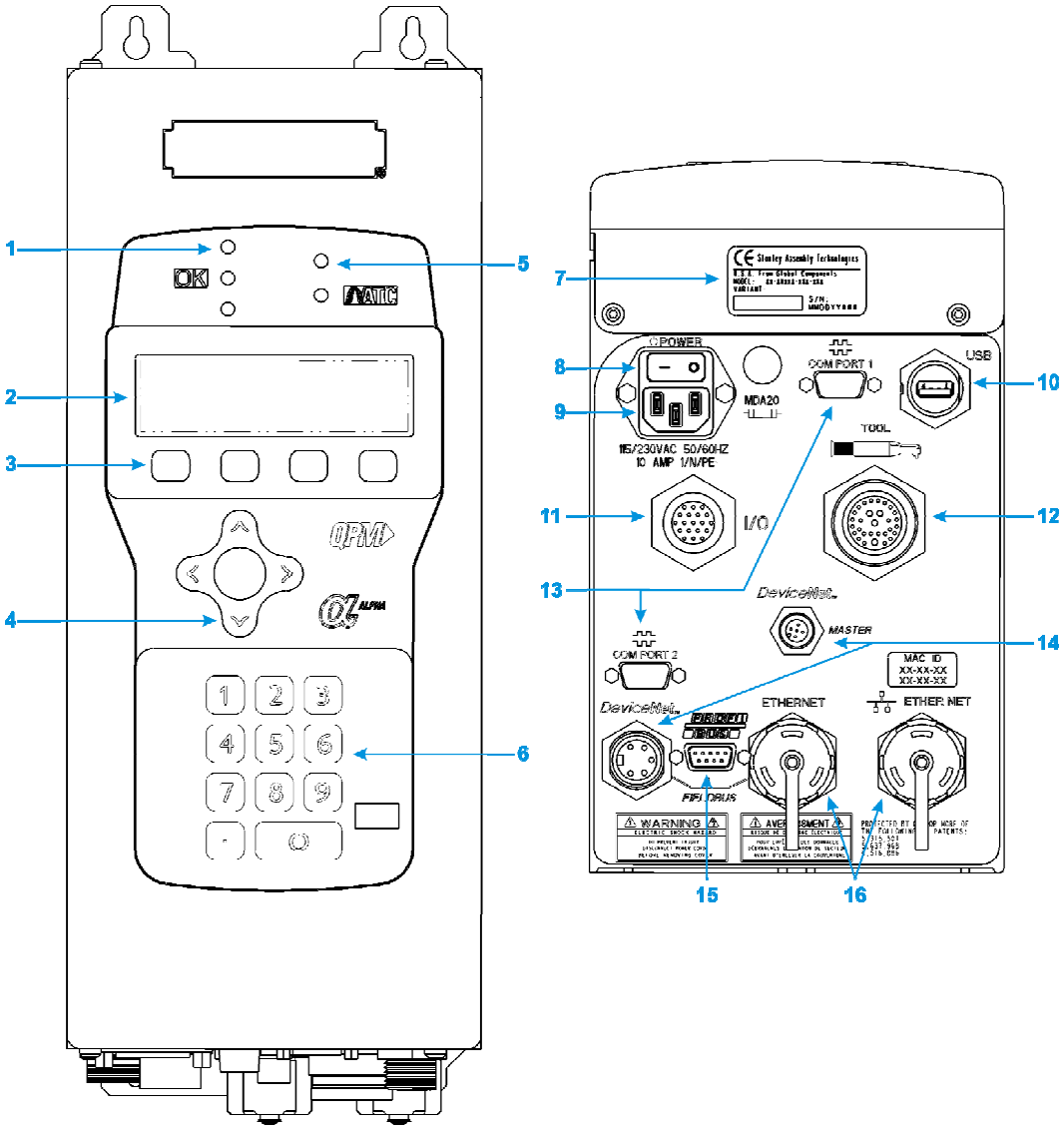
To Avoid Injury:

- Only allow suitably qualified personnel to install, program, or maintain this equipment and or system.
- These persons must be knowledgeable of any potential sources of danger and maintenance measures as set out in the Installation, Operations, and Maintenance manual.
- This product must be transported, stored, and installed as intended, and maintained and operated with care to ensure that the product functions correctly and safely.
- Persons responsible for system planning and design must be familiar with the safety concepts of automation equipment.

1.3 Specifications, Layout and Display

Dimensions	Width:	6.0 in	152 mm		
	Height:	14.2 in	361 mm		
	Depth:	10.3 in	262 mm		
Weight:		17 lb	7.7kg		
Operating Conditions:	Temperature:	32 to 122 ºF (0 to +50 ºC)			
	Humidity:	0 to 95 % non-condensing			
Power Source:	100 – 126 VAC, 50/60 Hz, 15 – 20A service or 207 – 253 VAC, 50/60 Hz, 10 – 16A service				
Power Consumption:	Stand by:		0.2 A (amperes)		
	Continuous:		1-2.5 kVA		
Tool Motor Power:	Service Rating:	E02/E_23	E_33/E_34	E44/E45	E55
Consumption	@ 115 VAC:	15A	15A	20A	---
	@ 230 VAC:	10A	10A	10A	16A
	Continuous kVA:	0.3	0.7	1	1.7

Alpha Controller



Item	Functional Description
1	Red, Green, Yellow LEDs for Limits Evaluation
2	Display
3	Function Keys with Active Label Above
4	Cursor Keys with Center Button to Expand Lists
5	Maintenance Due and ATC Active LEDs
6	Numeric Keypad to Enter Numbers or Select Options
7	Controller Label and Serial Number
8	Power Switch
9	Power Input
10	USB Port for Data Transfer
11	Optional 24 VDC Input/Output Connector
12	Tool Connector
13	Serial Connectors
14	Optional Device-Net Connector (Master / slave)
15	Optional Profibus Connector
16	Ethernet Connector (second one is optional)

1.4 Installation Instructions

W A R N I N G

To Avoid Injury:

- Always wear eye and foot protection when installing equipment.
- Only use equipment and accessories specifically designed to operate with Stanley assembly tools and use them only in the manner for which they are intended.
- Do not install worn, damaged, or modified equipment that may be unsuitable for safe use.
- Train all operators in the safe and proper use of power tools. Operators should report any unsafe condition.
- Store idle tools and accessories in a safe location accessible only by trained persons.
- Disconnect power source (air, electricity, etc.) from tool prior to making adjustments, changing accessories, or storing.
- Prior to operation, always check and test tools and accessories for damage, misalignment, binding or any other condition that may affect operation. Maintenance and repair should be performed by qualified personnel.
- Do not operate tools in or near explosive environments or in the presence of flammable liquids, gases, dust, rain or other wet conditions.
- Keep the work area clean, well lit and uncluttered.
- Keep unauthorized personnel out of the work area.

DC Electric Tools & Controllers:

- Install tools in dry, indoor, non-flammable, and non-explosive environments only – Humidity: 0 to 95% non-condensing and Temperature: 32 to 122 ºF (0 to +50 ºC).
- Installation, maintenance and programming should be performed by qualified personnel. Follow all manufacturer installation instructions and applicable regulatory electrical codes and safety codes.
- Tool and controller plugs must match the outlet. This equipment must be earth grounded. Never modify a plug in any way or use any adaptor plugs.
- Avoid body contact with electrically energized surfaces when holding a grounded tool**.**
- Prior to connecting a power source, always ensure the tool or controller is turned off.
- Limit controller access to trained and qualified personnel. Lock controller cabinets.

W A R N I N G

To Avoid Injury:

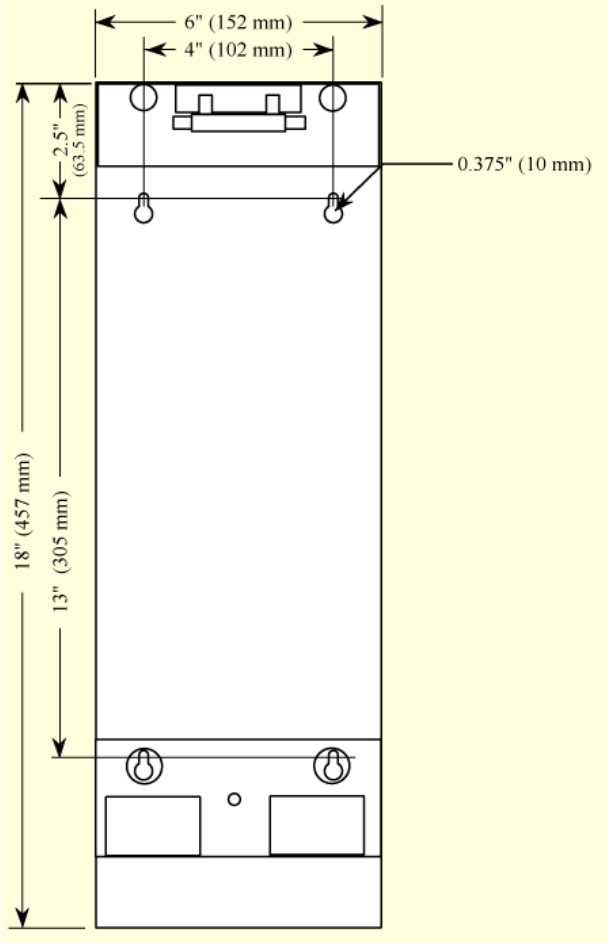
- Install modules in dry, indoor, non-flammable, and non-explosive environments only.
- Qualified personnel should perform installation and programming. Follow all manufacturer installation instructions, applicable regulatory electrical codes, and safety codes.
- Limit module access to trained and qualified personnel. Lock module cabinets.

W A R N I N G

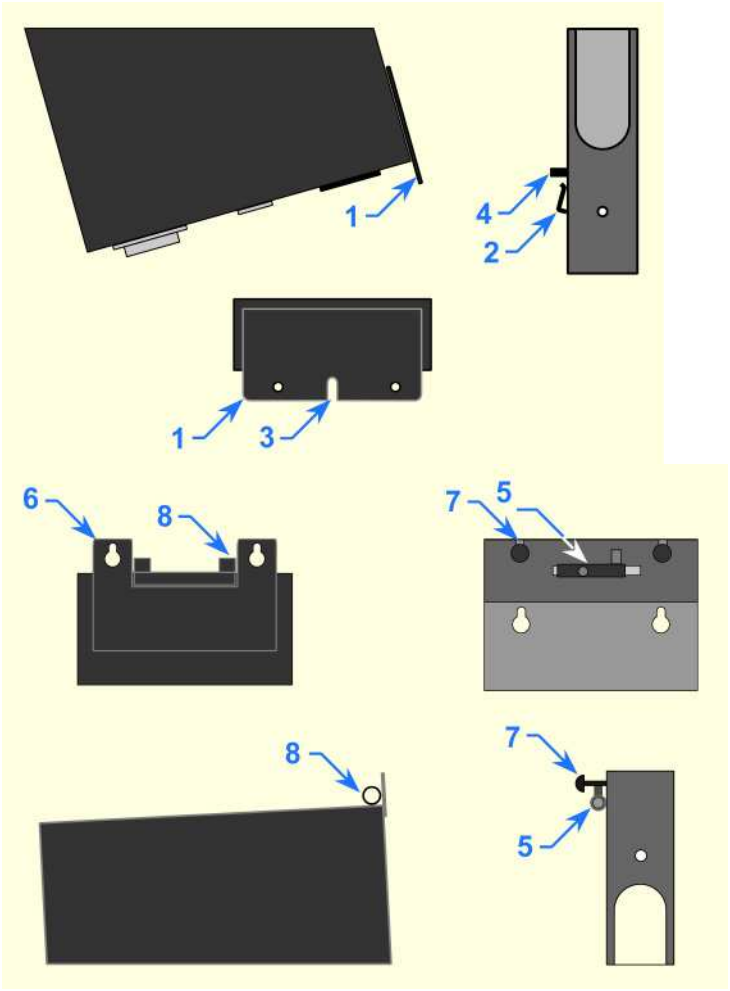
ELECTRICAL HAZARD

To Avoid Injury:

- Install modules in dry, indoor, non-flammable, and non-explosive environments only.
- Do not use this product near water, for example near a washbowl, wet basement, or the like.
- This product should be located away from heat sources such as radiators or other devices that produce heat.
- This product should not be subjected to vibration or shock or in close contact with water or other liquids.
- To minimize electrical interference, place the module as far away from possible sources of electrical noise, such as arc welding equipment.



Plinths connect to each other with four 10-32 machine screws through openings on the top and right side to threaded openings on the bottom and left side. When mounting plinths are placed next to each other, the center-to-center distance between the mounting holes in different plinths is 2" (50.8 mm). When mounting plinths are place one above another, the center-to-center distance between the mounting holes in different plinths is 6" (152.4 mm).



1. Install the Alpha Controller either directly to the wall or to a plinth.

2. Fasteners through four mounting holes secure plinths to a wall or other surface. Plinths can be connected using 10-32 threaded holes on the bottom and left side and through holes on the top and right side.

3. Make sure the bolts of the barrel-latches [**5**] on the plinth are retracted. Place the lower flange of the Alpha controller [**1**] into the lip [**2**] on the plinth.

4. Align the slot [**3**] in the flange with the lower mounting-pin [**4**] on the plinth while placing. Rotate the top of the controller back towards the plinth.

5. Place the openings on the upper flange of the controller [**6**] over the upper mounting pins [**7**] on the plinth. Release the bolts on the barrel-latches [**5**] making sure the bolts enter the two barrels [**8**] on the controller.

6. Connect the Alpha Controller to a power source.

7. Connect the tool cable to the Alpha controller and press the power switch on the controller.

8. The controller displays a language list at the first factory boot up. Press the up/down arrows to select a language, then press either OK from the interactive menu button or use the Toggle button to save the selection. The controller next displays the run screen and is ready for programming and operation.

1.4.1 Alpha Controller E-Stop Precaution

W A R N I N G

INTEGRATED E-STOP CIRCUIT NOT PRESENT
To Avoid Injury:
When a Alpha controller connects to a tool where a fault can result in personal injury or substantial damage to property, an E-stop circuit is required. An E-stop circuit must be created in the external power supply line.

Programming

2.1 Theory of Operation

The Alpha controller is designed as a high-end, full-feature, transducerized DC tool controller. It will control any QPM E or EA model series tool. It will not control EC model series tools.

2.1.1 Data Storage

Data associated with 10,000 fastening cycle results, 10 OK traces and 10 NOK traces is stored in the Alpha controller. This data can be retrieved with the Controller Gateway software or the Embedded Toolbox. SPC analysis is performed, by the Alpha controller, on the stored data.

2.1.2 Input and Output Elements

Bolt Count or Error Proofing functions are an integral part of the Alpha controller's functions. Its eight inputs and eight outputs on the optional 24 VDC connector support these functions to provide advanced plant integration by external devices such as a PLC.

The inputs and outputs are assignable, and configurable.

The Alpha controller supports other bus types such as the standard EthernetIP and ModbusTCP plus optional Profibus and DeviceNet. DeviceNet can be ordered as either Master or slave mode.

2.2 Software

Any computer with a modern web browser, connected on an Ethernet network, is used to view the Alpha controller's web-based application server and its Embedded Toolbox screens. Software is not loaded onto a computer to access the data or configure the controller.

The Controller Gateway connects to the Alpha, via a serial connection, and performs all the functions of the Embedded Toolbox. This software is required to reside on the end user's computer.

2.3 Embedded PLC

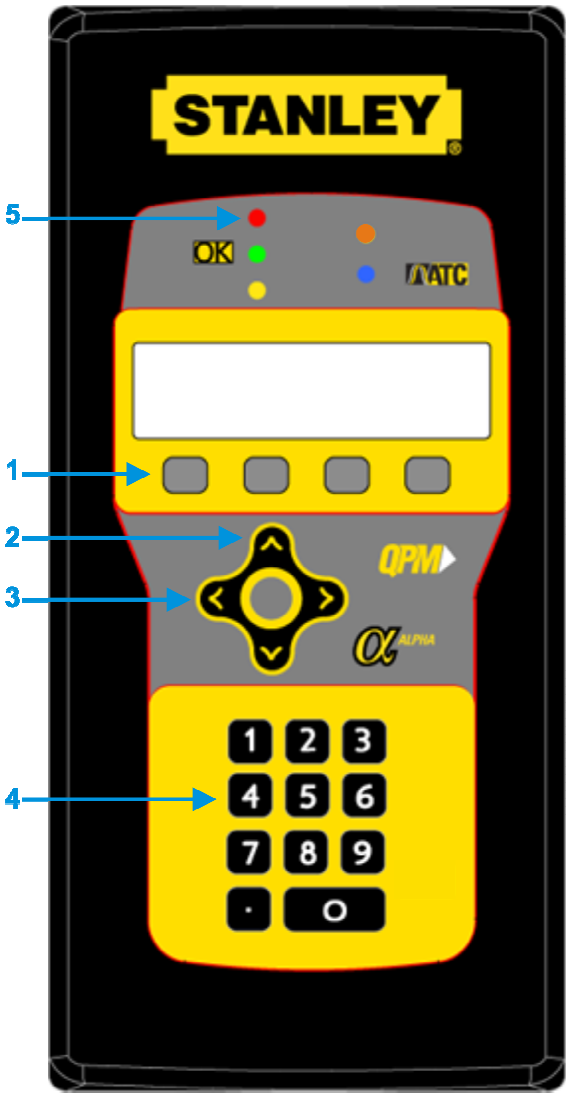
The Alpha controller comes with a software PLC that emulates many commands and features of the Allen Bradley SLC-500 series controller. Anyone with logic writing skills and the RSLogix500 program from Rockwell can program a logic file to add more versatility to the already abundant features of the Alpha controller.

2.4 Networking

Ethernet and the Internet Protocol using Transport Control Protocol are a powerful and robust means of moving data from one computer to another. Many end users rely on it to collect as much information from the plant floor equipment. The Alpha controller supports the XML, PFCS, TOOLSNET, OPEN and FORD version of OPEN protocols.

For those that haven't switch to the more robust means of collecting data, the Alpha controller supports the PFCS, OPEN and Toyota PI protocols over a serial connection.

2.5 QA Alpha Controller Navigation and Programming



The Alpha controller's three navigation and input areas facilitate menu navigation, selection and data input:

- Menu buttons
- Arrows and Toggle button
- Keypad

Labels for the four interactive menu buttons [**1**] change with menu selection. If the label is blank, the button has no function for the current display.

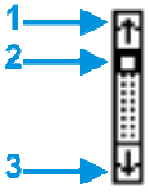
The up/down arrows [**2**] navigate menu and character selections; the left/right arrows enable backspace and space, as well as navigate between tabs. The Toggle button [**3**] switches between modes and selects/accepts choices (synonymous with ***OK*** menu button).

The numeric keypad [**4**] facilitates data input and menu selection (where applicable) and Job/Task selection when enabled.

The five LEDs [**5**] specify: Red indicates high torque/angle; Green indicates an OK fastening cycle; Yellow indicates low torque/angle; Orange indicates preventive maintenance is due on the tool; and Blue indicates when, during the fastening cycle, ATC is active.

2.6 Display

2.6.1 Scroll Bar



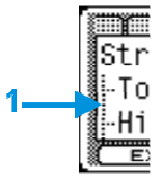
A scroll bar appears when more items are available than space within the display allows. The up arrow [**1**] and down arrow [**3**] direct scrolling. The black/white scroll bar [**2**] indicates which list items are currently displayed. No scroll bar means all items are currently displayed.

To navigate between menu items, use the up/down arrows or, if available, use the keypad to identify the corresponding menu item number.

2.6.2 Dropdown

A dropdown [**1**] arrow appears to the right of menu items with multiple choices. To view choices, highlight the menu item using the up/down arrows then use the Toggle button to expand the dropdown. Use up/down arrows to scroll and the toggle or interactive menu button to select/accept.

2.6.3 Menu Tree

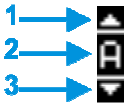


A menu tree [1] appears beside related menu items.

2.6.4 Tabs

Tabs [1] appear at the top when multiple menu selections exist. To navigate between tabs, use the left/right arrows. The active tab is white; inactive tabs are grey.

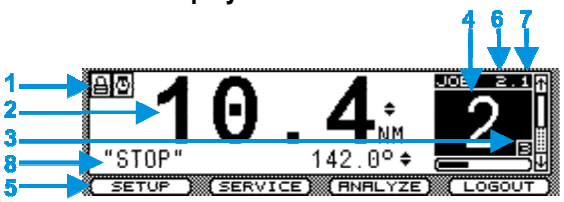
2.6.5 Character Scrollbar



This scrollbar enables adding: a-z, A-Z, 0-9, space, _, -, &, *, $, #, @, !, and a period (language and/or field determines character availability). The up arrow [1] and down arrow [3] direct scrolling with the active character [2] displayed between. Use the Alpha Controller's up/down arrows to scroll through character choices. The left arrow backspaces. The right arrow moves one position to the right to input next character. Push Toggle button or OK menu button to accept entry.

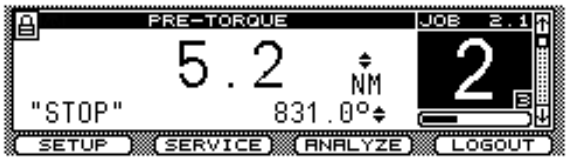
The following screens contain the character scrollbar option: Job (Name), Step (Name), System (Name General), System (Users).

2.6.6 Run Display



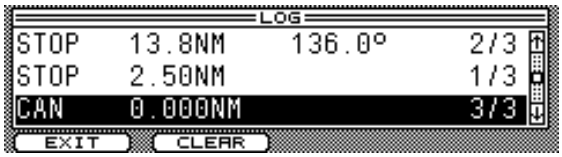
Icons identify events [1], see list below. Displays last torque and angle readings with units, when a tool is connected [2]. Up/down arrows next to the torque or angle value indicate the last fastening cycle NOK status whether it exceeded ▲ or did not achieve ▼ torque or angle limits.

Identifies the active Job [6] and active Task [7]. Identifies Target bolt count [3] and Accumulated bolt count [4] for the active Job. The side scroll bar indicates events are available in the Event Log. Press the down arrow to view the events. The number of fastening cycle attempts indicator is below the bolt count box. The run screen displays unless other programming functions [5] are in use. A Shutoff code is also displayed when applicable [8].



The run display changes to indicate the step in which the tool stopped (providing it did not stop during the audit step).

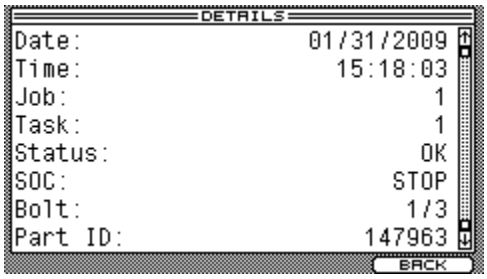
The display background color in normal operation is white. After an OK fastening cycle, the display background color changes to green for two seconds, then reverts back to white for the next cycle. After a NOK fastening cycle, the display background color changes to red for two seconds, then reverts back to white for the next cycle. The display background color turns red in the event of a fault; see section 2.7 Faults.



The Event Log lists the fastening cycles or faults that have occurred in the QA Alpha controller. While viewing the Run Display press the down arrow to access the Event Log.

Use the up/down arrow keys to scroll through the events listed chronologically (newest at the top, oldest at the bottom). Each line identifies an event. The first column indicates the fault, the fastening cycle status, or the fastening cycle shutoff code. The second column indicates the achieved torque during the fastening cycle. The third column indicates the achieved angle during the fastening cycle. The fourth column indicates the working bolt count.

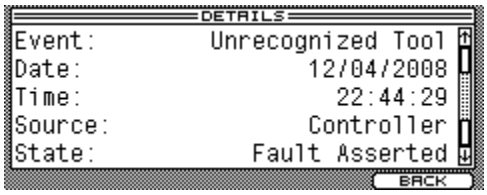
Press the Toggle button after selecting an event to display event detail.



Event Details: Fastening cycle

Lists details about the event and when it occurred. Most are self explanatory.

SOC: is Shutoff Code, see list below.



Event Details: Fault

Lists details about the event and when it occurred. Most are self explanatory.

State: Indicates when the fault asserted or cleared.

When Keypad Mode is set to Job or Task Select (see section 2.9.3.1 General Tab) at the run screen press the Toggle button or a number on the keypad. A Job/Task window opens. Use the toggle or interactive menu button to accept and switch controller operation to the selected Job/Task number.

When the Keypad Mode is set to PART ID (see section 2.9.3.1 General Tab) at the run screen press the Toggle button or a number on the keypad. A PARTID window opens. Use the up/down arrows to write a value to use as the PART ID. Press the OK interactive menu button to save it.

Shutoff Codes on the display indicate why a tightening cycle terminates prior to completion.

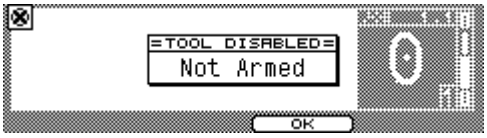
Shutoff Code	Description
TIME	Tightening time exceeds programmed cycle abort time value
STOP	Spindle stopped by either the operator or other device
>125%	Spindle stopped due to torque achieving greater than 125% torque limit for the spindle
FAULT	Precedes a fault described in section 2.7 Faults
STALL	Spindle in stall status
CAN	Can occur during a tightening cycle when a spindle firmware update is in progress

Alpha Controller Icons

Icon	Status	Description
	Locked	Password required to make changes
	Unlocked	Changes possible, automatically re-locks in time
	Busy/working	Wait
	Fault; system not operable	Check the run screen for Fault message
	Force on or off	Identifies an input/output forced on or off
	Active User	Appears beside the user on the User list that entered a password and unlocked the controller.

⊠ Stop Tool Operation (press trigger for cause)

Along with the onscreen indication, the blue light on the tool MFP extinguishes and the STOPPED output asserts.



Stop Tool Explanations

Undefined Task – The selected Task is not programmed to run a tool; select another Task or program currently selected Task.

Invalid Job/Task – Appears when a Job or Task number less than zero or greater than 99 is selected.

Network Protocol – The plant control system issued a Stop via a network protocol. Wait for the protocol to remove the Stop command.

Error Proofing – Bolt count has been met, reset with a Job Reset input.

Stop Issued – An Input is disabling the tool, remove the Stop input.

Invalid Job – The selected Job is wrong based on the validation inputs.

System Initializing – The controller is booting up, please wait.

Cycle Lock-out – The Cycle Lockout timer is active, wait for it to reset.

Not Armed – There are two things that can cause this event:

a) Tubenuts – By default tubenut tools require arming by tapping the MFB before the trigger is pressed to run the tool.

b) Reset Reject – The fastening cycle is NOK and the MFB mode is set to Reset Reject preventing the tool from running until the MFB is pressed to reset the NOK.

Reject Count Exceeded – Indicates the Reject Count has been exceeded.

2.7 Faults

The display background color in normal operation is white. In the event of a fault, the display background becomes red and the fault description appears on screen. The background color reverts to white only when the fault is cleared.

Overcurrent Fault!

There are two things that can cause this hardware fault:

a) GFI – the Ground Fault Interrupter has exceeded its current trip point. A current detector monitors the current through the three phases of the motor and asserts this fault when the total current applied to the tool does not equal the total current returned from the tool. All phases are turned off immediately to protect the controller from shorts at the tool end.

b) Total Current – the controller software limits the current applied to any tool based on what the tool can handle. This fault is asserted if there is a short at the tool end and the total current applied is greater than allowed.

Logic Voltage Fault!	The controller monitors the +5VDC, -5VDC and +12VDC of its onboard Power Supply. This fault is asserted when those voltages fall outside of nominal range.
Position Feedback Fault!	The controller is constantly monitoring the *resolver* zero and span points and asserts this fault if they go outside specification.
Transducer Span Fault!	This fault is asserted when the transducer zero point has shifted far enough to prevent a full scale reading from the transducer.
Temperature Fault!	This fault is asserted when the tool temperature detector has reached the temperature limit set by the Temperature Limit parameter. It resets after detected temperature has dropped by 5°C.
Unrecognized Tool!	The controller is communicating to the tool but does not recognize the model number written in the tool memory board.
Tool Communications!	The controller is not communicating to a tool.
Transducer Current Fault!	Transducer current has fallen outside nominal values. For E series tools that is 15.74 mA +/- 75% (4.5 – 26mA). For EA series tools that is 4.16 mA +/- 75% (1 to 7mA).
Transducer Zero Fault!	The transducer zero point has shifted too far for the controller to compensate. These points are visible on the controller diagnostics screen under Analyze.
Unsupported Tool!	The wrong tool type has been connected to the controller. The Alpha controller cannot run the tool that is connected.

2.8 Messages

Messages appear on the screen when certain non-critical conditions exist that asserts the warning. They may appear on any screen at any time.

Communication Fault	Used for Toyota PI protocol only. Controller has lost communications to the PI box.
Count Fault	Used for Toyota PI protocol only. Controller and PI box have a bolt count mismatch.
Program Fault	Used for Toyota PI protocol only. More tightening cycles were performed than the PI box expected.
Reboot Required	This message appears anytime the serial port or Ethernet parameters are changed.
Tool Update Failed	Controller failed to update the tool configuration.
Failed to Access Fieldbus	Hardware failure of the optional fieldbus card.
PLC Message	A user defined message controlled by the internal PLC.

2.9 Alpha Controller Programming

WARNING

EXCESSIVE TORQUE CONDITION
To Avoid Injury:

- Only trained and qualified personnel should program controllers.
- Never set control limits above the maximum rating of the tool.
- Setting control limits above the maximum rating of the tool can cause high reaction torque.
- Always test for proper tool operation after programming the controller.

The controller uses three main menus to display information and enable programming:

- ***Setup*** menu
- ***Service*** menu
- ***Analyze*** menu

To begin programming a tool strategy, press the ***Setup*** menu button.

1. Jobs – use to perform tool strategy programming such as torque and speed parameters.

2. Communications – use to program Ethernet, serial port, fieldbus and data protocol options.

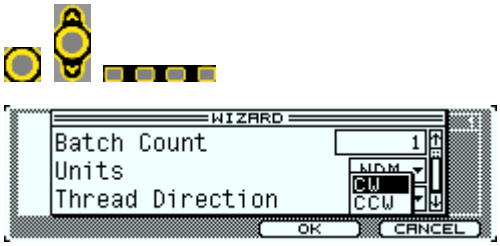
3. Other – use to set parameters for all other features, including system level, users, passwords, I/O and tool functions.

4. Restore Factory Defaults – use to backup/restore/delete programming and return controller to factory defaults.

To access, press the corresponding menu number on the keypad, or use the up/down arrow keys to highlight then press the Toggle button.

Icon Legend	Icon Description	Navigation
	Menu Buttons	Press to activate menu option noted above button.
	Left/Right Arrow Keys	Navigate tabs as well as backspace and space.
	Up/Down Arrow Keys	Scroll through menu selection and character selection.
	Toggle Button	Selects option for data input, accepts changes.
	Numeric Keypad	Data input and, when applicable, menu selection. Can be used for job selection when enabled to do so.

The left column shows the currently defined Alpha Controller settings and menu choices. The Options Screen column shows options for each selection. Screen navigation options appear above each screen.

Default Screens	Options Screen
	

NOTE:
Programming changes are stored after exiting current menu and returning to run screen.

2.9.1 Setup Menu: 1. Jobs

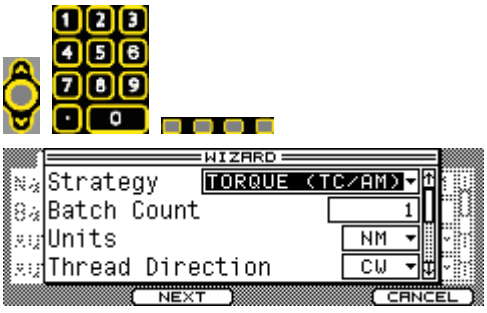
Jobs controls tool operation for tightening a fastener: one to ninety-nine Tasks and one to twelve Steps. Most controllers operate with a single Job and Task with one or two Steps. Users must have ADMINISTRATOR or SETUP access in order to modify Job settings. This includes Wizard, Manage and Step parameters.

The ***Wizard*** automatically appears after selecting Jobs if a tool is attached and a Job or Task is added. The ***Wizard*** sets a Job or Task for simple or complex tightening cycles using the optional strategy controls.

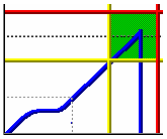
If no tool is attached or if at least one Job exists, the Job tab appears allowing for advanced user programming.

2.9.1.1 Wizard Screens

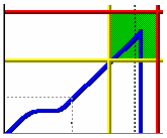
Wizard Screens	Options Screens
The ***Wizard*** presents programming parameters and gives a list of strategy controls.	



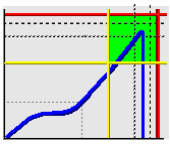
Strategy – Choose the strategy required for the Audit step of the job and task being programmed.



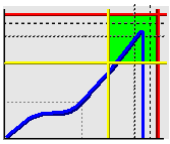
TORQUE (TC/AM): Torque Control with Angle Monitor. The controller shuts off the tool when the tool reaches the target torque value. The controller also monitors angle which can indicate changes in joint rate. Audit torque and angle results must fall within their specified limits for the fastening cycle to be acceptable.



ANGLE (AC/TM): Angle Control with Torque Monitor. The controller shuts off the tool when the tool reaches the target angle value after a selected snug torque value occurs. The controller also monitors torque. The final torque and angle readings must fall within their specified limits for the fastening cycle to be acceptable.



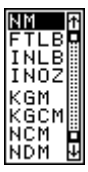
TORQUE & ANGLE: Angle Control and Torque Control. This strategy enables precision control for both torque and angle on critical joints. The controller shuts off the tool when the tool reaches both a target torque value and a target angle value after a selected snug torque value occurs. The final torque and angle results must fall within their specified limits for the fastening cycle to be acceptable. The controller also shuts off the tool, or bails out of the fastening cycle, when it determines that target torque and angle cannot be reached.



ANGLE OR TORQUE. Angle Control or Torque Control. The controller shuts off the tool when the tool reaches either a target torque value or a target angle value after a selected snug torque value occurs. The final torque and angle readings must fall within their specification limits for the fastening cycle to be judged acceptable.

Batch Count – The number of bolts in a group. Used with an error proofing remote input and output unit. Can be set for each parameter set. Acceptable values are between 1 and 99. The default value is 1.

Units – Tool operating units:



NM, Newton Meters

FTLB, Foot Pounds

INLB, Inch Pounds

INOZ, Inch Ounces KGM, Kilogram Meters

KGCM, Kilogram Centimeters

NCM, Newton Centimeters

NDM, Newton Decimeters

Wizard Screens	Options Screens

Thread Direction – Use CW (clockwise) for tightening right hand fasteners. Use CCW (counter-clockwise) for tightening left hand fasteners.

To modify, select using the up/down arrow keys then press the Toggle button. After all parameters/selections/options are finished, press the NEXT interactive menu button to advance through the ***Wizard***. Repeat for subsequent windows. Press the PREV interactive menu button to move back to previously programmed screens within the ***Wizard***.

Press the CANCEL interactive menu button at any time to stop ***Wizard*** operation.

High Torque – The ***Wizard*** uses the maximum torque for the connected tool.

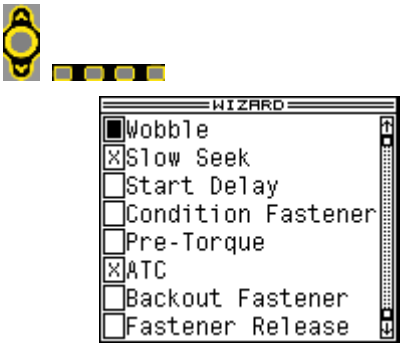
Low Torque – The ***Wizard*** uses zero as the low torque limit of the strategy.

Speed – The ***Wizard*** uses the maximum speed of the connected tool.

The final TC/AM step is now defined. The ***Wizard*** uses the median value, between the High and Low Torque parameters, as the Target Torque. It also calculates and programs other parameters automatically, including: Snug Torque, Threshold Torque, Statistical Torque and High Angle Bailout. Change these values after saving ***Wizard*** programming if desired.

Press the PREV interactive menu button to move back to previously programmed screens within the ***Wizard***.

Next, select the controls specific to your application. Option screens appear for each specific control chosen. The ***Wizard*** makes assumptions and calculates specific values, modify these values if necessary.

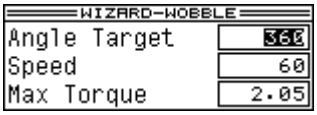


Use the Toggle button to select or deselect the controls specific to your application. Press the NEXT interactive menu button to view the option screens for each specific control chosen. The ***Wizard*** makes assumptions, calculates and presents specific values. Modify these values if necessary.

☐ Not Selected

☒ Selected

Wobble – Creates a step with an Angle Control/Torque Monitoring strategy that rotates the fastener in the opposite direction as the Audit step is programmed. The fastener threads align with the locking device threads before standard forward rotation and high speed are applied (prevents cross-threads). If selected, this will be the first step in the tool strategy. Options include:



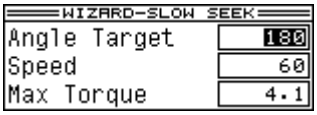
Angle Target – The number of degrees of rotation the socket turns during this step.

Speed – The socket speed during this step.

Max Torque – The maximum allowed torque during this step. A low value is calculated by

the ***Wizard*** to detect cross-threads.

Slow Seek – Creates a step with an Angle Control/Torque Monitoring strategy that rotates the fastener in the same direction as the Audit step is programmed. The flats of the socket align with the flats on the fastener before standard forward rotation and high speed are applied. Using Slow Seek as a first step also allows for cross-thread detection. If selected, this is the first step AFTER Wobble. Options include:



Angle Target – The number of degrees of rotation the socket turns during this step.

Speed – The socket speed during this step.

Max Torque – The maximum allowed torque during this step. A low value is calculated by the ***Wizard*** to detect cross-threads.

Start Delay – In some fastening situations, the initial fastening cycle torque is as high as or higher than the high torque specification limit for the joint. In some cases, particularly very large tools, this high initial torque is actually within the tool and not the joint. In other cases, such as thread rolling, overcoming friction in getting the fastener started causes the high initial torque. In order to compensate for this high initial torque, the Start Delay control allows the controller to initially ignore torque and angle for a specified amount of time at the start of a fastening cycle.

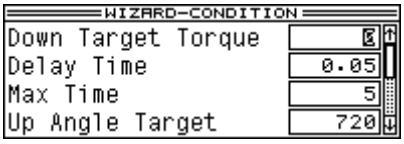
Creates a step with a Torque Control/Angle Monitoring strategy in the same direction as the Audit step is programmed. If selected, this is the first step AFTER Slow Seek. Options include:

Delay Time – The time the step is allowed to run, during which the controller ignores torque and angle. Triggered from the start of the fastening cycle and entered in seconds.

Max Torque – The maximum allowed torque during this step. The ***Wizard*** uses the maximum tool torque to prevent any interference.

Condition Fastener – Creates two steps before the Audit step. The first step is a Torque Control/Angle Monitoring strategy that rotates the fastener in the same direction as the Audit step is programmed. This runs a fastener down to an initial torque level. The second is a Backoff strategy which partially removes the fastener.

The purpose of this procedure is to polish the threads and reduce friction variation during the Audit step. This ensures more consistent results. If selected, this is the first step AFTER Start Delay and Pre-Torque. Options include:



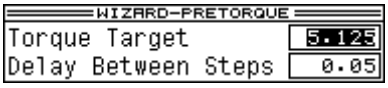
Down Target Torque – The Target Torque for this step prior to the Backoff.

Delay Time – The time delay before the controller starts the next sequential step. Triggered when the tool meets the Down Torque Target and entered in seconds.

Max Time – The maximum time permissible to have the tool energized during this step. Entered in seconds.

Up Angle Target – The target angle for the Backoff step.

Pre-Torque – The pre-torque runs the fastener to a preliminary torque level and suspends the fastening cycle for a period of time. After a time delay, the Audit step begins. If selected, this is the first step AFTER Start Delay. Options include:

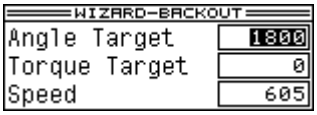


Torque Target – The Target Torque for this step.

Delay Between Steps – The time period to suspend the tool strategy before continuing.

ATC – (Adaptive Tightening Control) This is not a strategy or a step; it is an algorithm that modifies the tool's speed as the torque rises. Select ATC instead of downshift as an option to increase tool capability. If ATC is not selected, Downshift Mode for the Audit step is disabled.

Backout Fastener – Accomodates assembly procedures requiring partial removal of the fastener before additional components can be added to the joint. Creates a Backoff strategy step after the Audit step. The tool stops after achieving either the angle or torque target. If selected, this is the first step AFTER the Audit step. Options include:

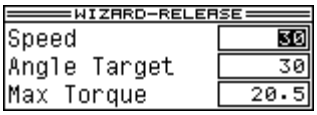


Angle Target – The number of degrees of rotation the socket turns during this step.

Torque Target – The Target Torque for this step.

Speed – The socket speed during this step.

Fastener Release – In some fastening situations sockets become stuck on the fasteners. This step reverses the tool and releases the socket without losing audit step data. Creates the last step in a tool strategy as an Angle Control or Torque Control (AC/TC) strategy that rotates the fastener in the opposite direction of the Audit step. Options include:



Speed – The socket speed during this step.

Angle Target – The number of degrees of rotation the socket turns during this step.

Max Torque – The maximum allowed torque during this step. The ***Wizard*** uses the maximum torque of tool to prevent any interference.

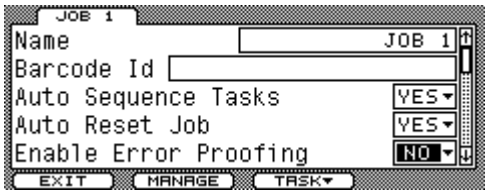
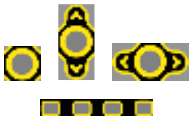
Press the FINISH interactive menu button to close the ***Wizard***.

The Job Tab screen appears. This allows parameter changes to be made prior to saving ***Wizard*** programming. To save, press the EXIT interactive menu button.

Press the YES interactive menu button to save changes. This saves the parameters and opens the Run screen.

2.9.1.2 Setup: Job Tab

Jobs, Tasks and Steps are required to setup a tool strategy. Inputs and Triggers are used to select specific Jobs or Tasks with different tool strategies, including Error Proofing (bolt counting). Program Job parameters according to the plant integration strategy desired and then program Task(s) and Step(s) to create the tool strategy.

Job Tab Screens	Options Screens
Job settings apply to all Tasks and Steps within the Job.	
 	Select Jobs by pressing the SETUP interactive menu button on the Run screen. Press 1 or highlight selection and press Toggle button.
 	 or  Name – Name the Job to define the operation performed (15 character maximum). Use the up/down arrows to spell with letters or use the numeric keypad.

Barcode Id – This is a mask that when equal to an incoming PART ID selects this Job as the active Job. The PART ID can come from the serial port, a network protocol, a fieldbus input, the internal PLC or the keypad itself. Use periods (.) to mask the negligible portions of the PART ID; use the exact characters in their exact PART ID positions to select the Job.

> Example: If a PART ID is *123ABC* and if the *3A* determines when this Job is to run (the third and fourth positions), then enter ***. . 3 A . .*** as the parameter value. Notice that the periods (.) match the length of the expected PART ID.

Auto Sequence Tasks – When set to *Yes*, the controller automatically sequences from Task 1 to the final Task in the Job after the fastener count in each Task is complete. *No* requires an input to select the Task to run within a Job.

Auto Reset Job – *Yes* resets the Job automatically after the Batch Count has been met. The tool will not disable with Error Proofing enabled. *No* requires an Input or Trigger to Reset the Job. The tool disables with Error Proofing enabled. If Error Proofing is disabled, the tool is always enabled but will not count higher than the Batch Count value.

Enable Error Proofing – *Yes* causes the tool to disable after the accumulated fastener count equals the target fastener count for the job, unless Auto Reset Job is set to Yes. A Trigger or Input is required to Reset the Job and set the accumulated count to zero. *Yes* also enables more parameters that will dynamically appear on the screen, see below. *No* keeps the tool enabled even after the Job's target count is met. The count will not increase beyond the target value. *No* will not cause new parameters to appear.

Disable Disassembly – This section identifies whether the tool removes the Disassembly (Reverse) function on one of the following events:

On Cycle OK – *Yes* does not allow the use of Disassembly mode after each OK

Job Tab Screens	Options Screens

fastening cycle. The tool can only be used to back out fasteners after a NOK fastening cycle. *No* allows the use of Disassembly mode after any fastening cycle unless the logic of the other two events is met.

On Job Complete – *Yes* does not allow the use of Disassembly mode after the active Job is complete (accumulated count equals target count). *No* allows the use of Disassembly mode after a Job is complete unless the logic of the other two events is met.

On All Fasteners Removed – *Yes* does not allow the use of Disassembly mode after all fasteners have been removed i.e. accumulated count is back to zero. *No* allows the use of Disassembly mode after all fasteners have been removed unless the logic of the other two events is met.

Disable Assembly – This identifies whether the tool disables after each Task has completed. This requires a Reset Job, Task Select or Task Select Bit input to select an incomplete Task which enables the tool for an incomplete Task only. If Auto Sequence Task is used, the tool re-enables when the active Task switches to an incomplete Task.

On Task Complete – *Yes* disables the tool when the active Task is complete. If an input switches the controller to a completed Task, the tool disables. *No* will not disable the tool when the active Task is complete.

Press the EXIT interactive menu button to save changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.

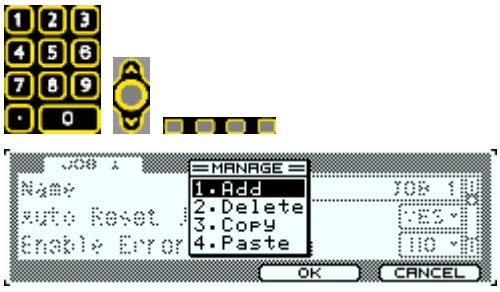
Press the MANAGE interactive menu button to Add, Delete, Copy or Paste Jobs. See section 2.9.1.3 Setup: Manage Button (Job) for further information.

Press the TASK interactive menu button to setup the parameters of the Tasks and Step(s) inside the selected Job. See section 2.9.1.4 Setup: Task Button for further information.

2.9.1.3 Setup: Manage Button (Job)

Manage Button (Job) Screens	Options Screen

Manage enables Jobs and their settings to be added, deleted, and/or copied to the clipboard and pasted.



Add – Adds a Job to the controller. If a tool is attached, the ***Wizard*** begins for easy setup of Job parameters. If a tool is not attached the Jobs tab appears for manual parameter setup.

Jobs do not have to be added sequentially. A Job can be added before or after the one that is selected. Jobs renumber automatically after being added. Make a selection and press OK to add a Job, or CANCEL to not add a Job.

Delete – Deletes the selected Job from the controller. Jobs cannot be recovered once deleted.

Copy – Copies the selected Job and its associated Tasks and Steps to the Clipboard.

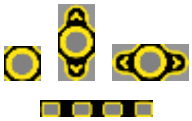
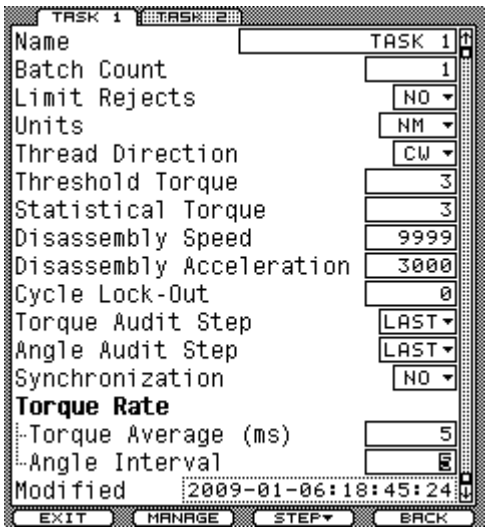
Paste – Overwrites the selected Job with the values residing in the Clipboard.

To move a Job: first create a new one where it is needed, next copy the Job to be moved, then paste it into the new one created and finally delete the original.

Press the EXIT interactive menu button to save changes and return to the Run screen. See

section 2.9.1.7 Setup: Exit.

2.9.1.4 Setup: Task Button

Task Tab Screens	Options Screens
Task settings apply to all Steps inside the Task.	
	Select Tasks by pressing the TASK interactive menu button.
	 or 
	Name – Name the Task to define the operation performed (15 character maximum). Use the up/down arrows for letters or use the numeric keypad. Batch Count – This is the number of fasteners the Job is required to count. Zero is not allowed. The maximum is 99. Limit Rejects – Limits the number of NOK fastening cycles in a Task. If the limit is achieved the tool is disabled. Use Reset Job, Task Select or Task Select Bit inputs to recover. *Yes* turns this function on and increases the Task menu to insert the Reject Count parameter. *No* turns this function off.  Reject Count – The maximum number of NOK fastening cycles allowed during this Task.

Units – Operating torque units. See section 2.7.1.1 for a list of available units. Each Task does not have to use the same operating torque units as the other Tasks.

Thread Direction – For tightening a right hand fastener use clockwise (CW). Use counter-clockwise (CCW) for left hand fasteners.

Threshold Torque – The torque level during the tightening cycle when the In Cycle Output transitions high. Data is not printed, or available to eTB, unless Threshold Torque is exceeded during the tightening cycle. A good starting point is 20% of Target Torque.

Statistical Torque – The torque level required to be exceeded before the fastening cycle data is included into Statistics or sent via a network protocol.

Disassembly Speed – The speed of the tool during (Reverse) operation in RPM (revolutions per minute).

Disassembly Acceleration – The rate at which the tool gets to Disassembly Speed in RPM/s (revolutions per minute per second).

Cycle Lock-Out – This is a timer, in seconds, that activates after the tool has reached its target. While active, it disables the tool.

Torque Audit Step – Identifies which step the fastening cycle torque data is received. The status of the Audit step determines which of the Red, Green and Yellow fastening cycle status

Task Tab Screens	Options Screens

lights is energized at the end of a fastening cycle. The value of LAST always chooses the last step programmed in this Task as the Audit step.

Angle Audit Step – Identifies which step the fastening cycle angle data is received. The status of the Audit step determines which of the Red, Green and Yellow fastening cycle status lights is energized at the end of a fastening cycle. The value of LAST always chooses the last step programmed in this Task as the Audit step.

Synchronization – *Yes* turns on the synchronization function. *No* turns off the synchronization function.

Torque Rate – This section sets values used in determining fastening cycle torque rate. This rate is then used in the Torque Rate or Yield Control strategies.

Torque Average – Number of Torque samples averaged for the Rate calculation. Calculates a running average from torque samples taken every millisecond. A higher number gives a smoother Rate.

Angle Interval – Angle interval used to calculate the Torque vs. Angle Rate. Larger intervals may give a smoother Rate.

Modified – A value that is changed by the controller to indicate the date and time parameter values were last changed in this Task.

Press the EXIT interactive menu button to save changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.

Press the MANAGE interactive menu button to Add, Delete, Copy or Paste Tasks. See section 2.9.1.3 Setup: Manage Button (Job) and replace the word Job with Task when managing Tasks in this section.

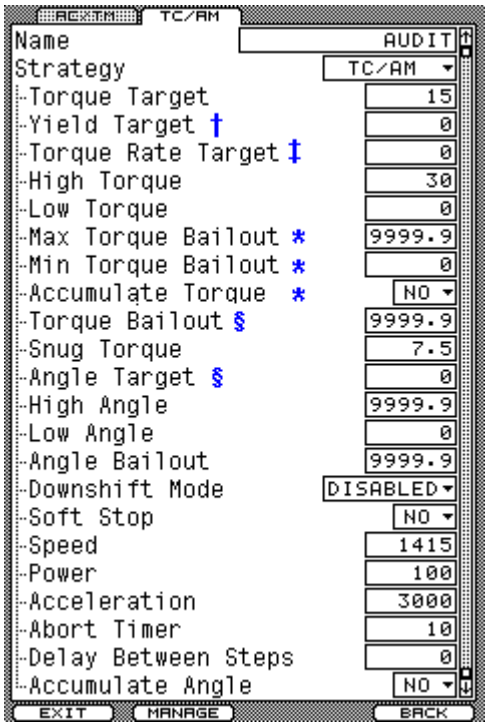
Press the STEP interactive menu button to setup the parameters of the Step(s) inside the selected Task. See section 2.9.1.5 Setup: Step Button for further information.

2.9.1.5 Setup: Step Button

Step Tab Screens	Options Screens

Step settings only affect the selected Job and Task. There can be only one Audit step per Task. Each step is represented by its own tab. Use the left/right arrow keys to select the tabs/steps for modifying.

Step Tab Screens



† Appears for YC/AM strategy only

‡ Appears for RC/AM strategy only

* Appears for AC/TA strategy only

§ Appears for any Angle Control strategy

Options Screens

Name – Provides an identifier for the step (15 character maximum). Use the up/down arrows for letters or use the numeric keypad.

Strategy – Identifies values used to control the tool during a step and to control the step's direction. Strategies include:

- TC/AM Torque Control/Angle Monitor
- AC/TM Angle Control/Torque Monitor
- AC/TC Angle Control/Torque Control
- AC/TA Angle Control/Torque Average
- RC/AM Rate Control/Angle Monitor
- YC/AM Yield Control/Angle Monitor
- BACK OFF Reverse Angle Control/Torque Control

Torque Target – The torque at which the controller shuts off the tool. Should be greater than Low Torque and lower than High Torque.

High Torque – The maximum peak torque for an acceptable tightening cycle (required for all steps). If the actual torque exceeds this limit the tightening cycle will be flagged as NOK and the RED LED on the front panel and tool illuminates. Must be greater than Torque Target and less than or equal to the rated torque marked on the tool.

Low Torque – The minimum peak torque for an acceptable tightening cycle. If the actual torque does not reach this limit, the tightening cycle is flagged as NOK and the YELLOW LED on the front panel and tool illuminates. Must be less than the Torque Target.

Torque Bailout – Determines when to stop the tool based on torque value during any Angle Control strategy. Should be equal to or above High Torque.

Snug Torque – The point in this step when the controller begins to monitor the tool's output angle. Should be greater than 0 and less than Low Torque. A value of 50% of Torque Target is a good starting point.

Angle Target – The angle at which the controller shuts off the tool. Should be greater than Low Angle and lower than High Angle.

High Angle – The maximum peak angle for an acceptable tightening cycle (required for all steps). If the actual angle exceeds this limit the tightening cycle will be flagged as NOK and the RED LED on the front panel and tool illuminates. Must be greater than Low Angle. Units are degrees of rotation.

Low Angle – The minimum peak angle for an acceptable tightening cycle. If the actual angle does not reach this limit the tightening cycle will be flagged as a NOK and the YELLOW LED on the front panel and tool illuminates. Must be less than High Angle. Units are degrees of rotation.

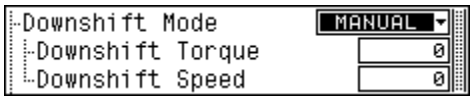
Angle Bailout – Determines when to stop the tool on angle during any Torque Control strategy. Should be set equal to or above High Angle. Units are degrees of rotation.

Downshift Mode – Selects the type of spindle inertia control toward the end of a tightening cycle.

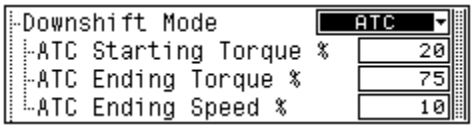
Step Tab Screens	Options Screens

Disabled – Does not reduce the speed of the motor.

Manual – Reduces the tool speed to a specific value (Downshift Speed) when a specific torque value (Downshift Torque) is reached during the tightening cycle. Speed units are RPM, torque is in torque units.

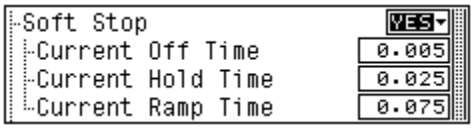


ATC – Enables the Adaptive Tightening Control algorithm to slow the tool speed as the torque rises.



The default values can be modified for when the algorithm starts (ATC Starting Torque), when it ends (ATC Ending Torque) and the tool speed after the algorithm ends (ATC Ending Speed). The torque units are a percent of Target Torque. The speed values are a percent of Speed.

Soft Stop – This controls how the tool is turned off AFTER reaching target torque. This is designed as an ergonomic benefit to ease operator discomfort with direct-drive tools. If *No* is selected the tool simply de-energizes and coasts to a stop.



If *Yes* is selected, the tool's current will be removed for the time specified in Current Off Time, then reapplied for the time specified in the Current Hold Time, then it will ramp to zero over the time specified in Current Ramp Time. Units are in seconds.

Speed – The velocity of the output of the tool during this step before any Downshift Mode activates (required for this step). Units are RPM. Must be greater than 0.

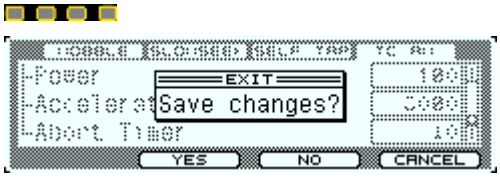
Power – The maximum power available to the tool to perform the tightening cycle (required for this step). Units are percent of maximum rated torque of the tool. Should not be less than 100%.

Acceleration – The rate the tool gets up to Speed in RPM/s (revolutions per minute per second) (required for this step). Should be greater than 1000 RPM/s.

Abort Timer – Stops the tool when the time has elapsed from the start of the step (required for this step). The value should be long enough to complete the tightening cycle during this step.

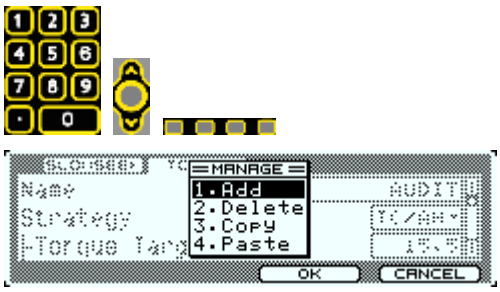
Delay Between Steps – The time the tool delays before proceeding with the next step in the Task. Entered in seconds.

Accumulate Angle – Allows angle to be accumulated between steps in multiple step strategies. *Yes* adds the active step's angle to the value achieved from the previous step. *No* turns this function off.



When finished modifying the tool strategy step(s), press EXIT, save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.

2.9.1.6 Setup: Manage Button (Step)

Manage Button (Step) Screens	Options Screen
Manage enables step settings to be added, deleted, and/or copied to the clipboard and pasted.	
	

Add – Allows the addition of more steps.

Steps do not have to be added sequentially. A Step can be added before or after the one that is selected. Steps renumber automatically after being added. Make a selection and press OK to add a Step, or CANCEL to not add a Step.

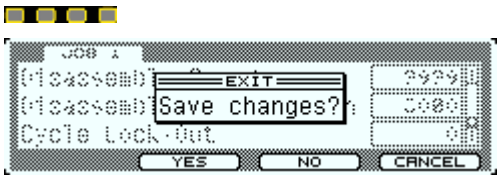
Delete – Removes the selected Step from the tool strategy. Steps cannot be recovered once deleted.

Copy – Copies the selected Step to the Clipboard.

Paste – Overwrites the selected Step with Clipboard values. The clipboard information must match the step for it to be successfully pasted.

To move a Step: first create a new one where it is needed, next copy the Step to be moved, then paste it into the new one created and finally delete the original.

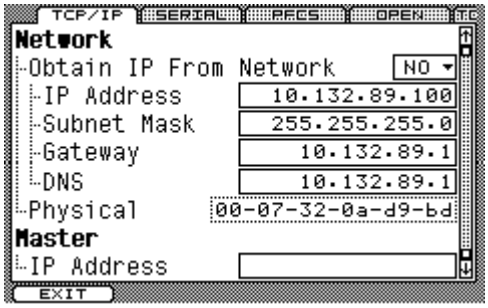
2.9.1.7 Setup: Exit

Exit Screens	Options Screen
Programming changes are stored after exiting current menu.	
	

2.9.2 Setup Menu: 2. Communications

Communication Screens	Options Screen
This area changes the setting of the Ethernet, Serial and fieldbus Communications port(s) located on the bottom of the Alpha. Users must have COMMUNICATIONS, SETUP or ADMINISTRATOR access level to modify values in this area.	
	Select Communications by pressing the SETUP interactive menu button on the Run screen. Press 2 or highlight selection and press Toggle button.

Communication Screens	Options Screen
	



2.9.2.1 TCP/IP tab

Network – This information is required when connecting the Alpha controller to an Ethernet network using its RJ45 jack.

Obtain IP From Network – Yes allows the Alpha controller to receive an address from the network DHCP server. BOOTP and RARP are not supported.

IP Address – The IP Address of the Alpha controller

Subnet Mask – The Subnet address of the Alpha controller.

Gateway – The Gateway address to a connecting network.

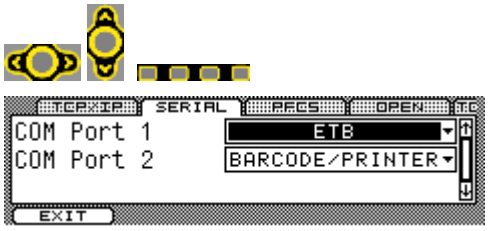
DNS – The address of the network's DNS server.

Physical – This is the MAC id of the RJ45 jack on the Alpha controller. This value comes from the Ethernet board inside and cannot be changed.

Master – Used when a Two-Spindle system is desired.

IP Address – The IP Address of the Master Alpha controller. This causes the working Alpha controller (identified under Network) to become a slave to the Alpha controller located at this IP Address. Both Alpha controllers must be connected using the same Ethernet switch to create their own Ethernet network. The fastening cycle data from the slave Alpha controller is sent to the master Alpha controller. The Master then presents both sets of data to other networks using the embedded protocols. PLC logic added to the master Alpha controller can help integrate both controllers into the end user's processes.

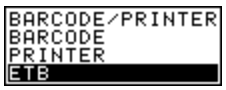
Use the right arrow to move to the next tab or press EXIT to save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.



2.9.2.2 Serial tab

COM Port 1 – Choose the function for this DB-9 connector on the bottom of the Alpha controller.

COM Port 2 – Choose the function for this DB-9 connector on the bottom of the Alpha controller.



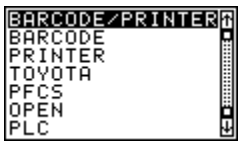
ETB – Allows the controller to communicate to the Controller Gateway software on a PC. See Appendix A – Embedded Toolbox Installation.

Printer – A pre-defined data string is sent to the port after each tightening cycle that exceeds the Threshold Torque. See section 4.1.3 Alpha Controller Serial Connector for string definitions.

Barcode – The port reads input from a barcode scanner and places it into the PART ID buffer. Data in the PART ID buffer is added to the fastening cycle data when stored and

transmitted via a network protocol or printed.

Barcode/Printer – The port performs both functions.



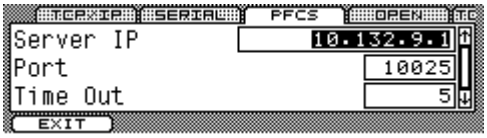
Toyota – Connects this port to the Toyota PI box.

PFCS – Connects this port to the Chrysler network.

OPEN – Connects this port to a network using the OPEN protocol with serial messaging.

PLC – The internal PLC takes over communications on this port.

Use the right arrow to move to the next tab or press EXIT to save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.



2.9.2.3 PFCS tab

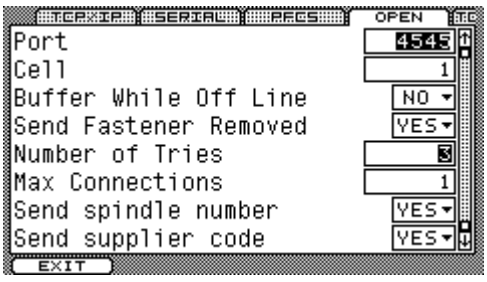
The plant's IT department must provide these values to allow the Alpha controller to communicate on the PFCS network.

Serve IP – Type the IP Address of the PFCS server on the network.

Port – Type the port number for this Alpha controller to communicate the PFCS protocol.

Time Out – If this is the Master Alpha in a Two-Spindle setup, this sets the time the master Alpha controller waits (after its fastening cycle finishes) to receive the fastening cycle results from the slave Alpha controller before sending both sets data to the network server. If it does not receive the slave's fastening results within this time, it sends a blank record for the slave.

Use the right arrow to move to the next tab or press EXIT to save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.



2.9.2.4 OPEN tab

The plant's IT department must provide these values to allow the Alpha controller to communicate on the OPEN protocol network.

Port – Type the port number for this Alpha controller to communicate the OPEN protocol.

Cell – Type the cell number where this Alpha controller resides.

Buffer While Off Line – *Yes* creates a buffer of 100 rundowns when the server connection is lost. Upon reconnection, the buffered rundowns transmit to the server. *No* does not buffer any rundowns when the server connection is lost.

Send Fastener Removed – *Yes* sends the FASTENER REMOVED message when the Alpha controller detects a tightened fastener is removed. *No* stops the message from transmitting.

Number of Tries – This is the number of times the Alpha controller sends a message to the

Communication Screens	Options Screen

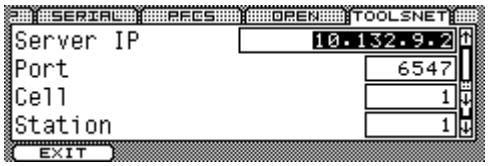
server when a no ACK message is received.

Max Connections – The number of connections the Alpha controller allows the server.

Send Spindle Number – *Yes* transmits the spindle number in the header of each message. *No* does not transmit the spindle number.

Send supplier code – *Yes* sends the Rev 2 ACK message. *No* does not transmit the Rev 1 ACK message.

Use the right arrow to move to the next tab or press EXIT to save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.



2.9.2.5 TOOLSNET tab

The plant's IT department must provide these values to allow the Alpha controller to communicate on the Toolsnet protocol network.

Serve IP – Type the IP Address of the Toolsnet server on the network.

Port – Type the port number for this Alpha controller to communicate the Toolsnet protocol.

Cell – Type the cell number where this Alpha controller resides.

Station – Type the Station number where this Alpha controller resides.

Use the right arrow to move to the next tab or press EXIT to save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.

2.9.2.6 XML tab

The plant's IT department must provide these values to allow the Alpha controller to communicate on the XML protocol network.

Results Port – The port on the XML protocol network server where the Alpha controller transmits messages.

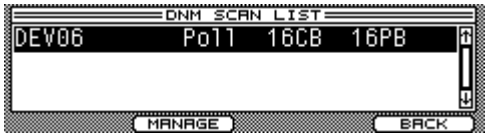
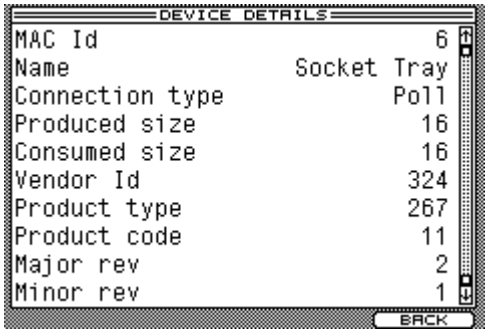
Command Port – The port where the Alpha controller receives commands from the XML protocol network server.

Use the right arrow to move to the next tab or press EXIT to save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.

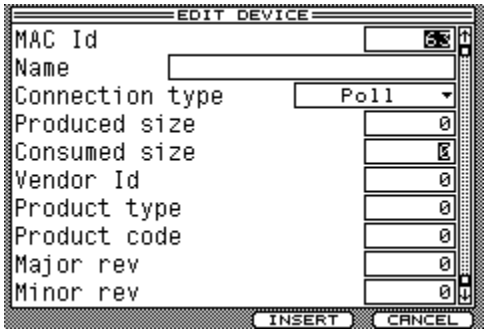
2.9.2.7 SCANNER tab

This tab appears on the Alpha controllers with the DeviceNet Master option.

Baudrate – Sets the communication rate of the DeviceNet network. The choices are 125 Kbits/s, 250 Kbits/s and 500 Kbits/s.

Communication Screens	Options Screen
Mac Id – Sets the node number of the Alpha controller on the DeviceNet network.	
 SCANLIST	 Press the SCANLIST interactive menu button to setup slave devices on the DeviceNet network. 
The devices added to the Scanlist are listed here. The first column identifies the device node number. The second column shows the type of communications used with the selected device. The third column indicates the number of bytes the device consumes. The fourth column reveals the number of bytes the device produces. Use the up/down arrow buttons to select the device. Press the Toggle button to get a detail window for the device.  Mac Id – The node number of the device on the DeviceNet network. Name – Identifies the device. Connection Type – The type of DeviceNet communications used with the device. Produce Size – This identifies the size, in bytes, of the device's output. Consumed Size – This identifies the size, in bytes, of the device's input. Vendor Id – This shows the unique DeviceNet OEM identifying number. Product type – The number indicating the type of device from the specified vendor. Product code – The number indicating the code of the product type of the specified vendor. Major rev – This identifies the major revision level for the device's product code. Minor rev – This identifies the minor revision level of the device's product code. Press the BACK interactive menu button to return to the Scanlist.	
 MANAGE	 Press the MANAGE interactive menu button to manage the devices in the Scanlist.
	Use the up/down arrows to select the option desired, then press the OK interactive menu button or press the corresponding number on the keypad.

1. Insert – Opens a device edit window to define the device before adding it to the Scanlist.

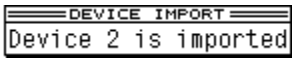


A value of 0 in any field is valid and can prevent conflicts with slave devices. See 2.9.2.7 SCANNER tab and Device Details for an explanation of terms. When finished editing, press the INSERT interactive menu button to add the device to the Scanlist.

2. Insert from EDS – Connect a USB memory stick to the USB port to import an EDS file.

Use the up/down arrow keys to select the correct file then press the IMPORT interactive menu button.

Enter a device node number then press the IMPORT interactive menu button to add the device to the Scanlist.



A message appears indicating the device has been added to the Scanlist. Press the OK interactive menu button to return to the Scanlist.

3. Delete – Deletes the selected device from the Scanlist.

Press the YES interactive menu button to delete the device from the Scanlist. Press the NO interactive menu button to keep the device on the Scanlist. Press the CANCEL interactive menu button to go back to the Scanlist.

4. Edit – Opens an edit window for the selected device. See 2.9.2.7 SCANNER tab and Device Details for an explanation of terms in the Edit window. When finished editing, press the APPLY interactive menu button to save the edits and return to the Scanlist.

Press the BACK interactive menu button to return to the SCANNER tab.

ONLINE

Press the ONLINE interactive menu button to perform a network scan or monitor the I/O on the DeviceNet network.

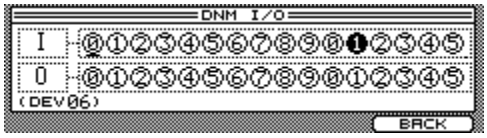
Communication Screens	Options Screen

Use the up/down arrows or the corresponding number on numeric keypad to select option.

1. Automatic Network Scan – The scanner scans the network and automatically adds devices it recognizes.

Press the YES interactive menu button to continue with the scan. Press the NO interactive menu button to return to the SCANNER tab. Any devices found will be added to the Scanner List. Use the SCANLIST interactive menu button to view devices.

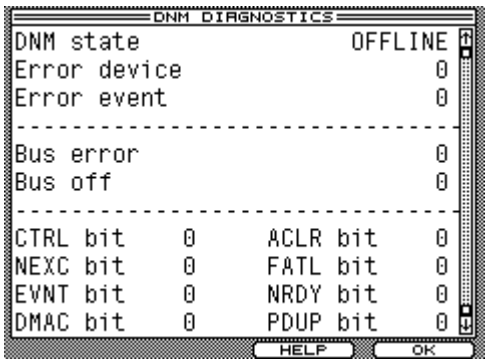
2. IO Monitor – Monitors the status of the I/O bits on the DeviceNet network.



Bits with a white background are OFF; bits with a black background are ON. Use the left/right arrows to scroll through I/Os longer than one word.

Press the BACK interactive menu button to return to the SCANNER tab.

Press the DIAG interactive menu button to diagnose the DeviceNet network.

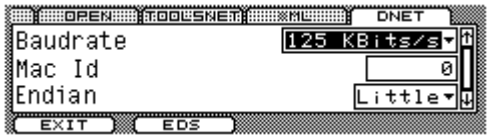
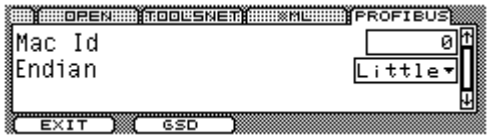


This information is for Stanley engineers' reference only.

Press the HELP interactive menu button to get a description of any errors.

Press the OK interactive menu button to return to the DNM Diagnostics screen. Press the OK interactive menu button again to return to the SCANNER tab.

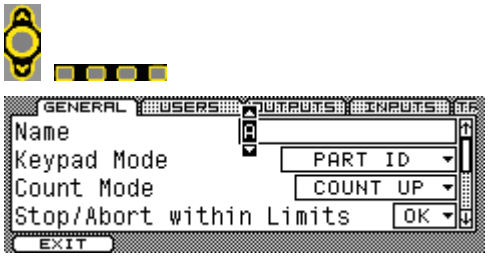
Use the right arrow to move to the next tab or press EXIT to save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.

Communication Screens	Options Screen
	**2.9.2.8 DNET tab** This tab appears for Alpha controllers with the DeviceNet slave port option. This tab sets communications parameters for the Alpha controller slave on a DeviceNet network. Baudrate – Sets the slave Alpha controller's communication rate on the DeviceNet network. Choices include: 125 Kbits/s, 250 Kbits/s and 500 Kbits/s. Mac Id – Sets the slave Alpha controller's node number on the DeviceNet network. Endian – Provides the correct byte order of DATA (words only not I/O or strings) when communicating to other devices. Choose *Little* for other PLCs and Intel devices. Choose *Big* for Motorola devices.
	Press the EDS interactive menu button to create an EDS file (equivalent to DeviceNet I/O map created using Embedded Toolbox). Connect a USB memory stick to the USB port on the bottom of the Alpha controller. Use the up/down arrows and/or the numeric keypad to type a file name. Pressing the OK interactive menu button saves the file to the USB memory stick. Use this controller generated EDS file in the PLC connected to the Alpha controller. If the DeviceNet I/O map is changed, a new EDS file must be generated.
Use the right arrow to move to the next tab or press EXIT to save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.	
  	**2.9.2.9 PROFIBUS tab** This tab appears on Alpha controllers with the Profibus slave port option. This tab sets the communications parameters for the Alpha controller slave on a Profibus network. The baudrate is determined automatically and set to the Network baudrate as determined by the master device. Mac Id – Sets the node number of the slave Alpha controller on the Profibus network. Endian – Provides the correct byte order of DATA (words only, not I/O or strings) when communicating to other devices. Choose *Little* for other PLCs and Intel devices. Choose *Big* for Motorola devices.

Communication Screens	Options Screen
	Press the GSD interactive menu button to create a GSD file equivalent to the Profibus I/O map created using Embedded Toolbox. Connect a USB memory stick to the USB port on the bottom of the Alpha controller. Use the up/down arrows and/or the numeric keypad to type a file name. Pressing the OK interactive menu button saves the file to the USB memory stick. Use this controller generated GSD file in the PLC connected to the Alpha controller. If the Profibus I/O map is changed, a new GDS file must be generated.

Use the left arrow to move to the next tab or press EXIT to save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.

2.9.3 Setup Menu: 3. Other

Other Screens	Options Screen
This area sets the parameters for all other Alpha features, including: system level, users, passwords, I/O and tool functions. Each category is represented by its own tab. Use the left/right arrows to select the tabs/category for modification. Users must have ADMINISTRATOR or SETUP access level to modify values in this area.	
	Use the up/down arrows to select the option desired or press the corresponding number on the keypad.
	**2.9.3.1 General Tab** Name – A name distinguishes this controller from other Alpha controllers on the same plant floor.

Keypad Mode – During normal operation the keypad on the face of the controller can be used to select Jobs (Job Select) or Tasks (Task Select). It can also write a PART ID for storing with fastening cycle data or these functions can be disabled.

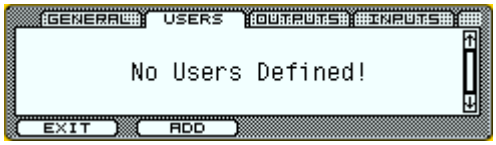
Count Mode – Choose *Count Up* to indicate the fasteners that have been completed OK. Choose *Count Down* to indicate the number of fasteners yet to be completed.

Stop/Abort within Limits – Choose *OK* to mark the fastening cycle as OK, even if the fastening cycle is stopped or aborted while the achieved torque and angle are within limits. Choose *NOK* to mark the fastening cycle as NOK (when the fastening cycle is stopped or aborted and the

Other Screens	Options Screen

achieved torque and angle values are within limits). When event occurs, this option illuminates the red and yellow LEDs on the tool and controller.

Use the right arrow to move to the next tab or press EXIT to save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.



2.9.3.2 Users Tab

To add a user, press the MANAGE interactive menu button.

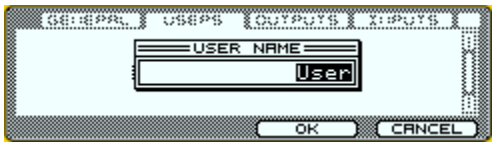
A maximum of eight users with unique passwords can be added. Passwords can contain any character, symbol or number combination (maximum length of 16).

If users are assigned, one must be an Administrator.

If the lock icon appears, the controller is password protected. The controller automatically re-locks the system 15 minutes after the last keypad input.

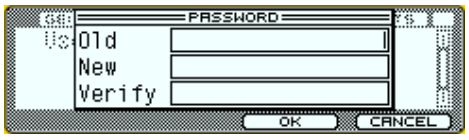
Adding users is a three step process, first add user by choosing option 1. Add:

Name user and press OK.



Second, select the new user.

Press the MANAGE interactive menu button and select option 3. Change Password.

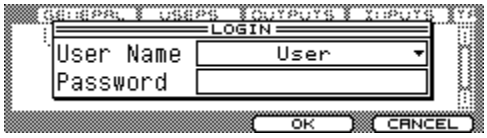


If this is the first time adding a password, leave the Old password blank. Otherwise, key the old password, arrow down and create a New password. Verify the password by typing it a second time. Press OK.

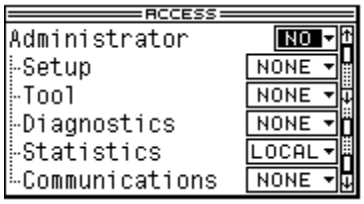
Third, change the access level of the new user, press MANAGE and select option 4. Change Access.

One user must be an Administrator. Administrator rights give a user full access to the controller. This enables all privileges including restoring factory defaults and adding users.

The Administrator must login to change user's access. The unlocked icon appears in the upper left corner of screen after Administrator login.



Select the Access level.



Each access is exclusive and must be assigned individually. Options include:

NONE denies access.
LOCAL allows access from the keypad.
REMOTE allows access from a computer.
BOTH allows access from the keypad and a computer.

Setup – Users at this level can modify all parameters in the Job and Communications areas. They may modify parameters under the Input, Output and Trigger tabs in the Other area.

Tool – Users at this level can modify parameters under the Tool tab in the Other area, as well as set Preventive Maintenance Threshold and reset the PM and Cycle counters in the SERVICE menu.

Diagnostics – Users at this level can force Inputs or Outputs ON or OFF and REMOVE forces in the I/O tab of ANALYZE.

Communications – Users at this level can modify the serial port settings.

Press OK to save.

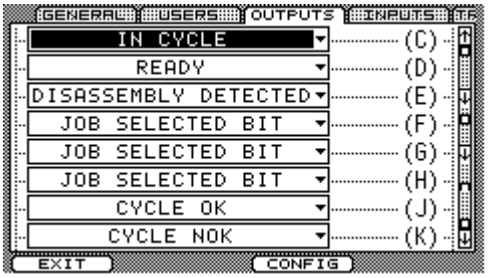
To delete a user press the MANAGE button and select option 2. Delete. Confirm deletion by pressing OK. This action requires the Administrator password; once entered, user is deleted.

Import – Users can be entered from a backup file. Connect a USB memory stick to the USB port, scroll to desired file and press IMPORT. The new users display on the User list.

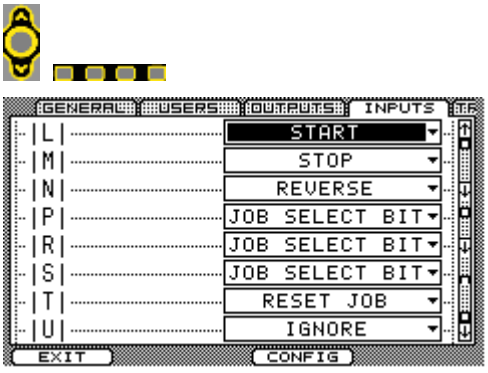
Export – To backup Users, connect a USB memory stick to the USB port, name the file, then press SAVE.

Press OK to save.

Use the right arrow to move to the next tab or press EXIT to save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.

Other Screens	Options Screen
	 **2.9.3.3 OUTPUTS Tab** The 24 VDC Connector has pins C through K designated as Outputs from the controller. The pin assignments are selectable on this tab. Use the up/down arrows to select the pin to assign, then press the Toggle button. A list of available output elements displays. See section 4.2.2 Output Descriptions for the complete list and descriptions. Highlight element to assign to the selected pin and press the Toggle button. An Output element can be assigned to more than one pin. The selected Output element must then be configured. See section 4.2 Assignable Input and Output Elements for configuration options and descriptions. Press CONFIG interactive menu button to configure the selected output element. After modifying press BACK. 

Use the right arrow to move to the next tab or press EXIT to save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.

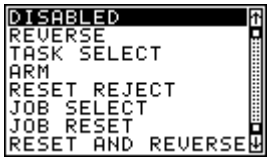
	 **2.9.3.4 INPUTS Tab** The 24 VDC Connector has pins L through U designated as Inputs to the controller. The pin assignments are selectable on this tab. Use the up/down arrows to select the pin to assign, then press the Toggle button. A list of available Input elements displays. See section 4.2.1 Input Descriptions for the complete list and descriptions. Highlight the element to assign to the selected pin and press the Toggle button. An Input element can be assigned to more than one pin. The selected Input element must then be configured. See section 4.2 Assignable Input and Output Elements for configuration options and descriptions. Press the CONFIG interactive menu button to configure the selected Input element. After modifying press BACK.

Other Screens	Options Screen
	

Use the right arrow to move to the next tab or press EXIT to save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.

2.9.3.5 TRIGGERS Tab

See section 3.4.2 MFB Mode for an explanation of the options. Options include:



Tap Action – Defines the operation when the MFB on the tool is tapped (pressed quickly).

Hold Action – Defines the operation when the MFB on the tool is held for one second.

Start Input – Defines which input starts the tool. In all cases, the 24 VDC Start input is always available to start the tool.

Any – Either the tool trigger or tool push-to-start switch starts the tool.

All – Requires that both the tool trigger and the tool push-to-start switch must be activated to start the tool.

Lever – Only the trigger on the tool starts the tool.

PTS – Only the push-to-start switch on the tool starts the tool.

None – Neither the tool trigger nor the tool push-to-start switch starts the tool.

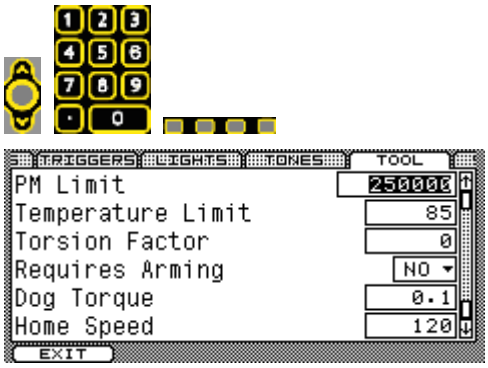
Use the right arrow to move to the next tab or press EXIT to save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.

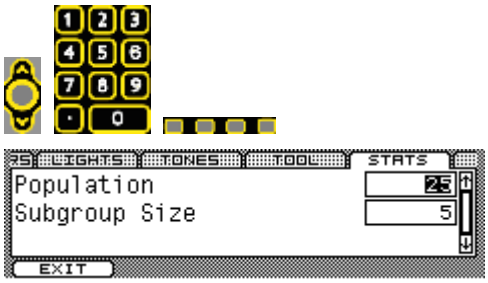
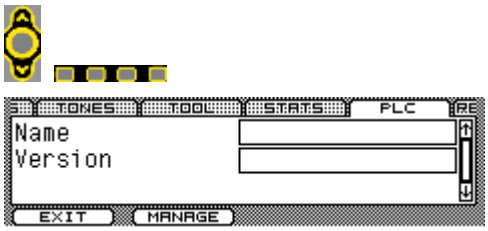
2.9.3.6 LIGHTS tab

Lights (1, 2) – Defines whether the lights indicate a Job or Task.

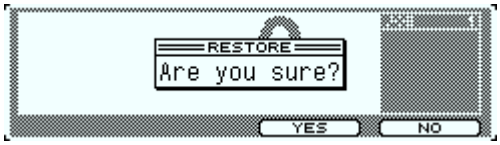
Headlight Timer – Sets the time the pistol tool headlights remain on, in seconds, after the trigger is pressed.

Enable Tool Light Timer – *Yes* enables the

Other Screens	Options Screen
	timer and the light, *No* disables the light.
Use the right arrow to move to the next tab or press EXIT to save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.	
	 **2.9.3.7 TONES Tab** The alarm in the tool handle can emit different tones based on the status of the tightening cycle. Choose an Accept Tone for an OK tightening cycle and a Reject Tone for a NOK tightening cycle.  PLAY – previews the selected tone. STOP – stops playing the tone.
Use the right arrow to move to the next tab or press EXIT to save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.	
	**2.9.3.8 TOOL Tab** Values modified under this tab are saved to the tool not the controller. Users must have TOOL or ADMINISTRATOR access level to modify these values. PM Limit – When the PM Counter in the tool exceeds this threshold, the preventive maintenance LED on the front panel illuminates indicating it is time to perform maintenance on the attached tool. Temperature Limit – Identifies the threshold, in degrees Celsius, for tool shut off. This is caused by excessive duty cycle on the tool. Torsion Factor – See Appendix B – Torsion Compensation for an explanation of this parameter and how to determine a correct value. Otherwise, use the default (zero). Requires Arming – Forces the Tap Action on the MFB to Arm. See section 3.4.2 MFB Mode. Tubenut tools require arming as a factory setting. Dog Torque – Sets the torque level at which the tubenut stops when it returns home.

Other Screens	Options Screen
	Home Speed – Sets the speed of the tubenut tool when it returns home.
Use the right arrow to move to the next tab or press EXIT to save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.	
	**2.9.3.9 STATS tab** Sets values required to calculate the statistics on the stored fastening cycle data. Population – Sets the number of fastening cycles included in statistical analysis. Subgroup Size – Sets the size of the subgroups for the population.
Use the right arrow to move to the next tab or press EXIT to save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.	
	 **2.9.3.10 PLC Tab** If a PLC logic file is running, the Name and Version is identified. If a PLC file is not running, the Name and Version are blank. Press the MANAGE interactive menu button to Import, Export or Delete a PLC file. Connect a USB memory stick in the USB port for Importing and Exporting.
Use the right arrow to move to the next tab or press EXIT to save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.	
	 **2.9.3.11 REGIONAL Tab** Select language. 
Use the right arrow to move to the next tab or press EXIT to save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.	

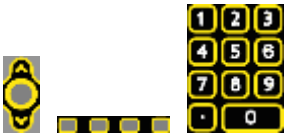
2.9.4 Setup Menu: 4. Restore Factory Defaults

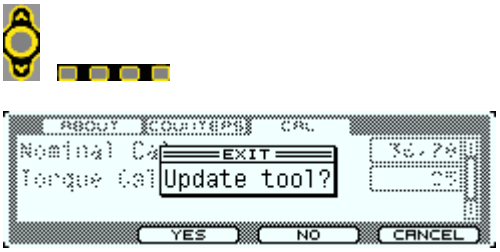
Restore Factory Defaults Screens	Options Screen
  	 Use the up/down arrows to select the option desired or press the corresponding number on the keypad. The BACKUP interactive menu button writes the values for the entire Alpha controller to the USB memory stick. The RESTORE interactive menu button reads an Alpha controller backup file on the USB memory stick and overwrites all values in the Alpha controller. The DEFAULTS interactive menu button restores all values for all parameters to factory default settings. This helps when a controller is in an unknown programmed state. Requires ADMINISTRATOR privileges. 
Press EXIT to save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.	

2.9.5 Service

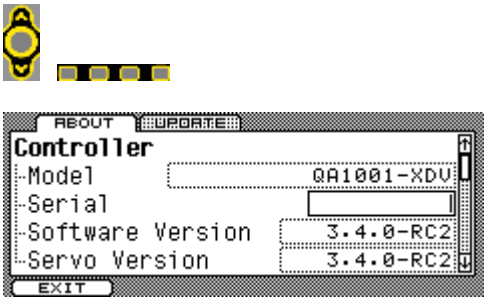
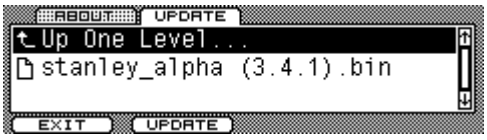
2.9.5.1 Tool

Tool Tab Screens	Options Screen
The Service area presents information about the tool and controller. Users must have TOOL or ADMINISTRATOR access level to modify parameters.	
 SERVICE	1. Tool All tool parameters are stored in the tool memory board in the tool's handle. This area reads/writes values to the tool memory board, not to the controller 

Tool Tab Screens	Options Screen
 	***2.9.5.1.1 About Tab*** This tab displays information about the tool currently attached to the controller. Only the Serial value field is editable. If there is no serial number, enter one (can only be entered one time).
Use the left/right arrow to move to the next tab or press EXIT to save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.	
 	***2.9.5.1.2 Counters Tab*** Each of the three counters increments at the same time after an OK tightening cycle. Odometer – Cannot be reset. Indicates the total number of OK tightening cycles the attached tool has performed over its lifetime. PM Counter – Causes the preventive maintenance LED to illuminate (on front panel and tool) when this value exceeds the PM Threshold. Trip Counter – Counts the number of OK tightening cycles between resets. Use the RESET button to reset (back to zero) either the PM Counter or the Trip Counter. 
Use the left/right arrow to move to the next tab or press EXIT to save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.	
 	***2.9.5.1.3 CAL Tab*** Nominal Cal – This is a calculated value based on the torque output of the motor, the gear ratios and efficiencies. This is a reference value only and cannot be modified. Torque Cal – This is the specific torque calibration value for the tool. Enter a new value after performing a lab certification. The Torque Cal should not deviate from the Nominal Cal value by more than 20%. Modified - A value that is changed by the

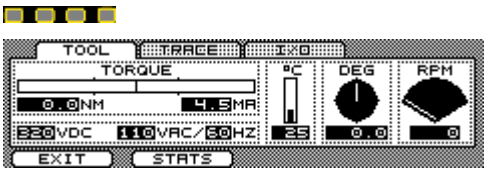
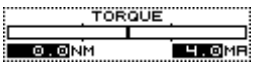
Tool Tab Screens	Options Screen
	controller to indicate the date and time the tool was last calibrated. Press EXIT when finished modifying the value.
	

2.9.5.2 Controller

Controller Tab Screens	Options Screen
SERVICE	 2. Controller 
	About Tab This tab displays information about the controller. These values are read only unless blank. The Model and Serial fields can be written to once. Press EXIT when finished.
	Update Tab This tab is used to update the firmware in the Alpha controller. Get the binary file from your Stanley representative. Put the file onto a USB memory stick. Install the USB memory stick to the USB port on the bottom of the Alpha controller. Scroll to the binary file provided and then press the UPDATE interactive menu button.

Controller Tab Screens	Options Screen
	A new screen appears to confirm the action. Press YES to continue with the update. Press NO to cancel the update.
	A progress bar on the bottom of the screen indicates the file transfer status from the USB memory stick to the Alpha controller memory.
	When the file transfer is complete, a new window appears indicating it is time to reboot the controller to complete the upgrade. Turn off the controller, wait 20 seconds, then turn on the controller.
	After the controller starts, it checks that the file is complete and written to permanent memory. The controller auto-reboots. When the run screen appears, the controller is updated and ready.
	During the file transfer process, a file error can cause the transfer to abort and this message appears. Contact your Stanley representative if this happens.
	This screen appears if the update file is for a different controller. Contact your Stanley representative if this happens.

2.9.6 Analyze

Analyze Screens	Options Screen
Analyze displays tool and controller diagnostic information, traces and I/O status.	
	Press the ANALYZE button to perform diagnostics on the controller, tool or I/O, look at fastening cycle traces, perform Statistical Process Control analysis, or to download fastening cycle or fault data.
	Tool Tab This tab shows live status. It updates every millisecond. Use this tab to perform controller or tool diagnostics during troubleshooting operations.
	Transducer Health – The thickness of the vertical line within the horizontal bar indicates transducer health (a thicker line means less healthy). Once the line reaches the tick mark, on

either side of center, the transducer needs to be replaced.

Transducer Torque – Provides a live transducer torque value during the tightening cycle.

Transducer Current – The transducer is powered with a constant current value. This current should be present and not varying. See section 2.7 Faults for limits.

Controller DC Bus voltage – The bus should always be approximately 320 VDC.

Controller AC Supply Voltage/Frequency – See section 1.3 for controller AC volts specification.

Tool Temperature – Temperature is not measured during tool operation. This interacts with the Temperature Limit parameter. See section 2.9.3.8 TOOL Tab.

Tool Output Angle – Identifies the number of circular degrees of rotation on the tool output. Resets at each start.

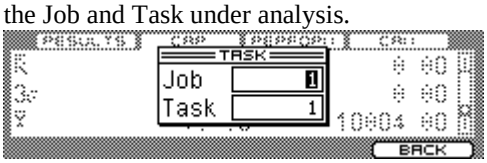
Tool Output Speed – Identifies the real time speed of the tool output.

Press the STATS interactive menu button to enter the Statistics area of the controller.

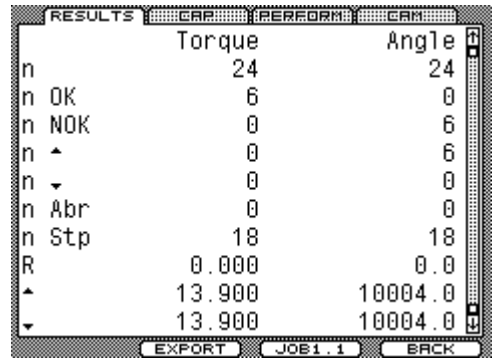
Alpha controllers maintain both sample and population statistics. Sample statistics are calculated using the last completed subgroup of rundowns for a given Task. The subgroup size is set using Subgroup Size. Population statistics are calculated using all of the rundowns for a given Task up to the Population Size.

To be included in sample or population statistics, a rundown must exceed the Task's Threshold Torque and Statistical Torque.

The statistics are calculated for Torque and Angle. Data is filtered by Task. Press the JOB1.1 interactive menu button and choose the Job and Task under analysis.



Values are recalculated each time a tab is selected.



Results Tab

This screen shows a summary of the fastening cycle data results stored in the controller.

n – Shows the number of rundowns included in the population size.

n OK – Identifies the number of OK rundowns.

n NOK – Identifies the number of NOK rundowns.

n ▲ – Displays the number of fastening cycles that exceeded the high limit.

n ▼ – Displays the number of fastening cycles that did not achieve the low limit.

n Abr – Displays the number of fastening cycles that were aborted.

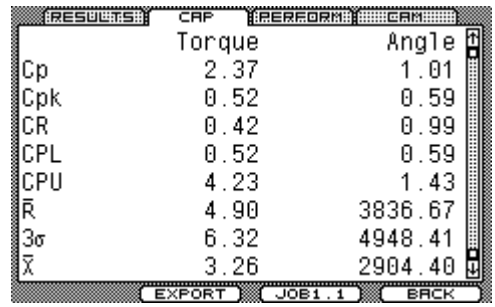
n Stp – Shows the number of fastening cycles that were stopped.

R – Shows the subgroup range (highest minus lowest value).

▲ – Identifies the highest value of all the fastening cycles in the population

▼ – Identifies the lowest value of all the fastening cycles in the population

Use the right arrow to move to the next tab or press BACK to return to the Analysis screen.



Capability Tab

This screen shows the capability statistics for the selected Job and Task.

Cp – Displays the capability index for a stable process.

Cpk – Displays the capability index for a stable process, typically defined as the minimum of CPU or CPL.

CR – Displays the capability ratio for a stable process and is simply the reciprocal of C_p.

CPL – Shows the lower capability index.

CPU – Shows the upper capability index.

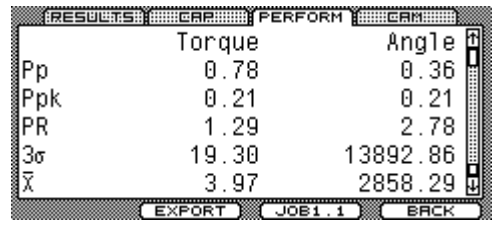
R bar – Identifies the average range of a constant size subgroup series.

3σ – Displays the sample estimated Standard Deviation times three.

X bar – Displays the value's average (mean).

Use the right arrow to move to the next tab or press BACK to return to the Analysis screen.

Analyze Screens	Options Screen



Performance Tab

This screen shows the performance statistics for the selected Job and Task.

Pp – Shows a performance index of a stable process.

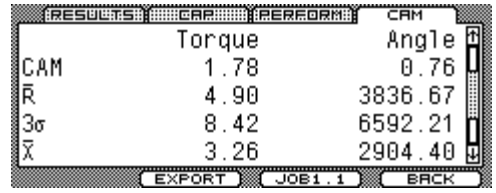
Ppk – Shows a performance index of a stable process typically defined by a minimum of two calculations.

PR – Identifies the performance ratio for a stable process.

3σ – Identifies the sample estimated Standard Deviation times three.

X bar – Displays the value's average (mean).

Use the right arrow to move to the next tab or press BACK to return to the Analysis screen.



Coefficient D'aptitude Moyen Tab

This screen shows the CAM statistics for the selected Job and Task.

CAM – *Coefficient d'Aptitude Moyen* (Mean Aptitude Coefficient) shows a capability index for a stable process used in Europe.

R bar – Identifies the average range of a constant size subgroup series.

3σ – Identifies the sample estimated Standard Deviation times three.

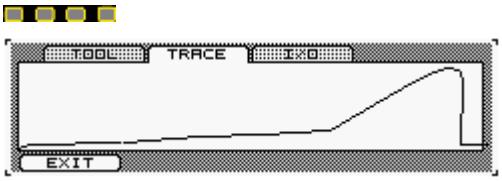
X bar – Displays the value's average (mean).

Use the left arrow to move to the next tab or press BACK to return to the Analysis screen.

Press the EXPORT interactive menu button to export Rundown Data or Fault Event Data to the USB memory stick.

Connect a USB memory stick to the USB port on the bottom of the Alpha controller. Use the up/down arrows and/or the numeric keypad to select option.

Use the up/down arrows and/or the numeric keypad to type a file name. Pressing the OK interactive menu button saves the data to the USB memory stick.

Analyze Screens	Options Screen
After the file is saved, press the OK button. Press BACK to return to the Analysis screen.	
Use the left/right arrow to move to the next tab or press EXIT to save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.	
	TRACE Tab This tab plots a torque verses time curve after every tightening cycle. The Y-axis is scaled from 0 to rated torque of the attached tool. The X-axis has a variable scale to include the entire tightening cycle.
Use the left/right arrow to move to the next tab or press EXIT to save the changes and return to the Run screen. See section 2.9.1.7 Setup: Exit.	
	I/O Tab This tab indicates the real time status of the 24VDC Inputs and Outputs. Forcing the I/O on or off is also performed here. Users must have DIAGNOSTICS or ADMINISTRATOR access level to force I/O.

Each 24VDC connector pin is represented. Pin A is for supplying 24VDC to the I/O elements. Pin V is the 24VDC Return to complete the current loop. Pin B is the bus for the Outputs. See Section 4.1.8 Alpha Controller (Model QA1001 __V) Input and Output Connector for a schematic. Pins L through U are for Inputs. Pins C through K are for Outputs. See Sections 2.9.3.3 OUTPUTS Tab and 2.9.3.4 INPUTS Tab to assign elements to the pins.

A clear Input or Output pin icon identifies it as OFF; a dark Input or Output pin icon identifies it as ON.

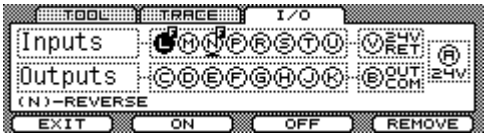
There is a horizontal bar/cursor under the active pin; Use the Left/Right and Up/Down arrow keys to move the bar/cursor. The text at the screen's bottom left corner indicates the active pin's assigned element.

Manually control the I/O by forcing pins either ON or OFF. Applying force means the pin will always be in that forced state and does not toggle to the opposite state (even if the system requires it to toggle). This is useful for troubleshooting signals that integrate with other equipment.

Move the horizontal bar/cursor under a pin and press the ON interactive menu button to force it on, press the OFF interactive menu button again to force it off. When the force is no longer required, press the REMOVE button to remove the force and return the pin to system control.

When forcing I/O changes during operation, the system provides a warning first.

A clear pin icon with a small F indicates the pin is forced OFF. A dark pin icon with a small F indicates the pin is forced ON.



If a force is active when the EXIT button is pressed a prompt appears.

Choose the YES interactive menu button to remove the force(s) and return to the run screen. Choosing the NO interactive menu button does NOT remove the force(s), it returns to the run screen. The system runs with forces applied until they are removed or until the controller's next power cycle.

QPM DC Electric Tools

This chapter promotes proper and safe use and gives guidance to owners, employers, supervisors and others responsible for training and safe use by operators. DC electric tools from **STANLEY ASSEMBLY TECHNOLOGIES** are intended for use in industrial threaded fastening or precision position and or adjustment applications only. Some instructions may not apply to all tools. Please contact your Stanley Sales Engineer for information or assistance on Stanley training for assembly tool operation.

3.1 Tool Specifications

Operating Conditions	Temperature	32 to 122 ºF (0 to +50 ºC)
	Humidity	0 to 95 % non-condensing

Noise Level: A-weighted emission sound pressure level at the work station < 70dBA (ref 20µPa) as determined according to ISO 15744-2002.

Vibration Level: Weighted root mean square acceleration value at the handle < 2.5 m/s^2 as determined according to ISO 8662.

STANLEY ASSEMBLY TECHNOLOGIES hereby declares the following sound and vibration emission levels as required by the Machinery Directive 98/37/EC.

Product	A-weighted emission sound pressure level at the work station L_{pA} (ref 20µPa). Value determined according to ISO 15744-2002 * using as basic standards ISO 3744 and ISO 11203	Weighted emission root mean square acceleration level at the handle. Value determined according to ISO 8662 * (single axis)
E0, E1, E2, EA2, E3, EA3, E4 and E5 electric tools	< 70dBA	< 2.5 m/s^2

* Operating conditions for all measurements: full rated speed, no load, rated supply voltage or pressure.

A-weighted emission sound power level L_{WA}: not required, declared sound pressure emission levels are below 85dBA.

C-weighted peak emission sound pressure level L_{pCpeak}: not applicable to these products.

Uncertainty K_{pA}, K_{WA}, K_{pCpeak}: not relevant, declared levels are maximum values.

W A R N I N G

To Avoid Injury:
This information is provided to assist in making rough estimates of sound and vibration exposure levels in the workplace. The declared emission values were obtained by laboratory type testing in accordance with the stated standards. **Levels measured in individual workplaces may be higher.**
The actual exposure levels and risk of harm experienced by an individual user depends upon the work piece, workstation design, duration of exposure, and the physical condition and work habits of the user. To help prevent physical impairment, a program of health surveillance is highly recommended to detect early symptoms which may relate to sound and/or vibration exposure, such that appropriate preventive measures may be taken.

3.2 Operator Protection

WARNING

ROTATING EQUIPMENT
To Avoid Injury:

- Always wear eye and foot protection when operating, installing, or maintaining power tools, and when in areas where power tools are being used, maintained, or installed. Some applications may require the use of safety glasses and face shields. Use eye protection that conforms to ANSI Z87.1.[3] and ANSI Z41-PT99M I/75 C/75.
- Always stay alert when operating tools and/or their accessories. Do no operate tools and/or their accessories while tired, under the influence of drugs, alcohol or any other mind-altering substance.
- Repetitive work motions or vibration may be harmful to your hands, arms, shoulders or back.
- Use suitable protective equipment and work methods whenever an application presents a hazard.

3.2.1 Repetitive Motion

The use of power tools may involve highly repetitive motions of the fingers, hands, wrists, and shoulders. These repetitive motions can lead to cumulative trauma disorders (CTD). Many personal and workplace factors can contribute to these disorders.

Currently available data have identified the following risk factors. These risk factors are not necessarily causation factors of CTDs. The mere presence of a risk factor does not necessarily mean there is excessive risk of injury. Generally, the greater the exposure to a single risk factor or combination of factors the greater the risk for CTDs.

- Forceful exertions and motions
- Extreme postures and motions
- Repetitive exertions and motions
- Intended duration of exertion, postures, motions, vibration, and cold
- Insufficient rest or pauses
- Work organization risk factors
- Environmental risk factors

These risk factors span job design and content, operator training, work method, work pace, work environment, proper tool selection and other work place factors beyond the control of the tool manufacturer. Tool owners and employers should analyze jobs for all of the risk factors identified above and take appropriate action.

Some measures which may reduce the risk of CTDs:

- Use minimum hand grip force consistent with proper control and safe operation.
- Keep wrists as straight as possible.
- Avoid repetitive movements of the hands and wrists.
- If wrist pain, hand tingling, numbness, or other disorders of the shoulders, arm, wrist or finger occur; notify supervisor, discontinue task, reassign user to a different job; if relief is not found contact experts skilled in treating such disorders.

Wrist supports, torque reaction devices, and balancers should be used if it can be determined that such devices can reduce the risk of repetitive motion disorders.

3.2.2 Hearing Protection

Power tool operators and adjacent personnel may be exposed to excessive sound levels. The tool in use is generally only one of many sources of noise that an operator experiences. Other tools and machines in the area, joint assembly noise, work processes, and other ambient noise sources all contribute to the sound level operators are exposed to.

The actual sound level an individual is exposed to and the individual’s exposure time over the work day are important factors in determining hearing protection requirements. Worker sound level exposure can only be determined at the job site and is the responsibility of tool owners and employers.

Measure worker sound level exposure and identify high-risk noise areas where hearing protection is required.

Follow federal (OSHA), state or local sound level statues, ordinances and or regulations.

3.2.3 Vibration

Power tools can vibrate during use. To minimize the possible effects of vibration:

- Keep hands and body dry.
- Avoid anything that inhibits blood circulation such as tobacco, cold temperatures and certain drugs.
- Operators should notify their employer when experiencing prolonged symptoms of pain, tingling, numbness or blanching of the fingers.
- Wear vibration damping gloves if it can be determined that they reduce the risk of vibration disorders without introducing other hazards.

3.2.4 Breathing Protection

Respirators shall be used where contaminants in the work area present a hazard.

3.3 Tool Installation

W A R N I N G

To Avoid Injury:

- Always wear eye and foot protection when installing equipment.
- Only use equipment and accessories specifically designed to operate with Stanley assembly tools and use them only in the manner for which they are intended.
- Do not install worn, damaged, or modified equipment that may be unsuitable for safe use.
- Train all operators in the safe and proper use of power tools. Operators should report any unsafe condition.
- Store idle tools and accessories in a safe location accessible only by trained persons.
- Disconnect power source (air, electricity, etc.) from tool prior to making adjustments, changing accessories, or storing.
- Prior to operation, always check and test tools and accessories for damage, misalignment, binding or any other condition that may affect operation. Maintenance and repair should be performed by qualified personnel.
- Do not operate tools in or near explosive environments or in the presence of flammable liquids, gases, dust, rain or other wet conditions.
- Keep the work area clean, well lit and uncluttered.
- Keep unauthorized personnel out of the work area.

DC Electric Tools & Controllers:

- Install tools in dry, indoor, non-flammable, and non-explosive environments only – Humidity: 0 to 95% non-condensing and Temperature: 32 to 122 ºF (0 to +50 ºC).
- Installation, maintenance and programming should be performed by qualified personnel. Follow all manufacturer installation instructions and applicable regulatory electrical codes and safety codes.
- Tool and controller plugs must match the outlet. This equipment must be earth grounded. Never modify a plug in any way or use any adaptor plugs.
- Avoid body contact with electrically energized surfaces when holding a grounded tool**.**
- Prior to connecting a power source, always ensure the tool or controller is turned off.
- Limit controller access to trained and qualified personnel. Lock controller cabinets.

Turn controllers off when removing or attaching tools.

Stanley electric tools must be connected to a controller to operate. To ensure superior performance and safe operation, use a Stanley controller specifically designed for each tool. These instructions are specific to Stanley electric tools when used with Stanley electric tool controllers and accessories. Some features may not be applicable, performance may be degraded and some safety systems may not be available when tools are connected to non-Stanley controllers and accessories.

3.3.1 Sockets and Adapters

Use only industrial grade sockets and adapters (power bit and power or impact socket type).

Replace worn or damaged sockets that are unsuitable for safe operation immediately.

Always ensure drive socket is fully seated and locked into position before connecting power to tool.

3.3.2 Suspension Devices

Tool suspension devices or bails help support the weight of the tool during tightening operations. Attach these devices securely and periodically inspect them for damage or loosening.

3.3.3 Cable Installation

WARNING

ELECTRICAL HAZARD
To Avoid Injury:

- Never use a tool with a damaged cable.
- Never abuse a cable, carry a tool by its cable, hang a tool by its cable, or pull on a cable to disconnect it from the tool or the controller.

To ensure superior performance and safe operation, use the Stanley cables specifically designed to operate these tools.

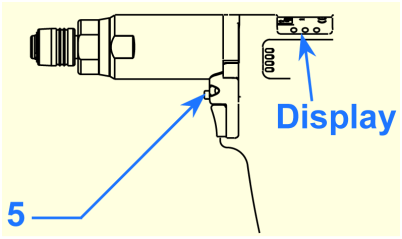
Never use a tool with a damaged cable. Never abuse a cable, carry a tool by its cable or pull a cable to disconnect it. Also, keep the cord away from heat, sharp edges, or moving parts.

Use cables of appropriate length (60M maximum) for each application; position and or suspend them in such a way as to prevent tripping and cable damage, and to provide good work area maneuverability.

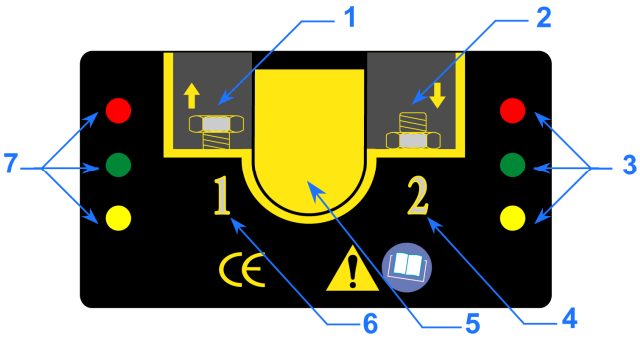
3.4 QPM Tools

3.4.1 Display and Multiple Function Button for Hand Held Tools

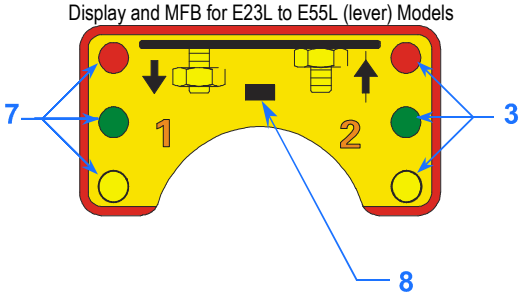
Handheld QPM tools have a display and a multiple function button (MFB). Two sets of lights [**3** and **7**] indicate tightening cycle status. Two blue lights indicate whether the tool is armed (on) or not armed (off) and tool rotation direction, disassembly [**1**] or assembly [**2**]. A single multiple function button [**5**] can change tool direction and or parameter sets. When the button is used to select the Job, one of two orange indicators [**4** or **6**] illuminates to show the active Job. EA tools have four sets of lights [**3** and **7**] and an LED [**8**] indicates when the tightening cycle count exceeds the PM limit.



Display and MFB for E02P to E34P (pistol) Models



Display and MFB for E23L to E55L (lever) Models



Display for EA23L to EA34L (lever) Models

3.4.2 MFB Mode

The *MFB Mode* configures the multiple function button for handheld QPM tools. The button can be configured to operate-in any of the following modes.

Disable (default)	The button does nothing.
Reverse (Disassembly)	Pressing the button toggles between assembly and disassembly and illuminates the appropriate blue light [**1**] or [**2**]. All tool status lights [**3**] and [**7**] flash when the tool is in disassembly mode.
Job/Task Select	Pressing the button toggles between Job/Task 1 and Job/Task 2 and illuminates the appropriate orange light [**6**] or [**4**].
Arm	Pressing the button arms (activates) the trigger but does not start the tool. The blue assembly light [**2**] comes on to show that the tool is armed for three seconds.
Reset Reject	This function, when selected, will cause the tool to disable after a NOK tightening cycle. The Reject Tone, when enabled, will sound. Pressing the button re-enables the tool indicating the operator acknowledges the rejected tightening cycle and wishes to repair it.
Job Reset	Pressing the button causes the selected Job to be reset. This means that the fastener count is set to zero and the tool, if disabled due to Error Proofing requirements, re-enables.
Reset and Reverse	This function, when selected, causes the tool to disable after a NOK tightening cycle. The Reject Tone, when enabled, will sound. Pressing the button re-enables the tool in the Reverse direction and indicates that the operator acknowledges the rejected tightening cycle and wishes to repair it. The tool switches to the forward direction after the controller detects a fastener has been removed.

3.4.3 Tool Memory

QPM tools have an onboard tool memory that stores tool identification, calibration factors and tightening cycle counters. Memory parameters include:

- *Model Number*
- *Serial Number*
- *Torque Cal* (calibration) factor
- *Angle Cal* (calibration) factor
- Tightening cycle counters

3.4.4 Tightening Cycle Counters

QPM tools have onboard counters that record the number of tightening cycles completed by the tool.

- *Odometer Counter.* Records the total number of tightening cycle completed.
- *Trip Counter.* Records the number of tightening cycles completed since the last reset.
- *PM Counter*. Records the number of tightening cycles completed since the last reset.
- *PM Threshold*. A static value set by the end user. When the PM Counter exceeds the PM Threshold (Limit), the controller provides a maintenance alert. The alert is an orange LED on the front panel and the tool.

The controller reads the tightening cycle counters from the tool on each power up.

3.5 Tool Operation

WARNING

ROTATING SPINDLE
To Avoid Injury:
- Always wear eye and foot protection when operating and when in areas where power tools are being used.
- Keep all body parts and clothing away from the rotating end of the tool. Dress properly. Do not wear loose-fitted clothing or jewelry.

TORQUE REACTION FORCE
To Avoid Injury:
- Be alert and maintain good balance, footing, and posture at all times in anticipation of the tool's torque reaction. Do not over-extend or over-reach.
- Be prepared for the change in direction and or a higher reaction force when a tool is in reverse.
- The start lever should be positioned to avoid trapping the operator's hand between the tool and the work piece.

TOOL MAY NOT SHUT OFF
To Avoid Injury:
- If the tool does not shut off at the end of the tightening cycle, contact the person responsible for tool installation or repair. Note: When the tool does not shut off, a stall condition occurs. A stall condition can cause a higher than expected torque reaction impulse.
- Ensure tool is properly installed, adjusted and in good working order.
- Do not use the power tool if the switch does not turn it on and off.
- Apply the tool to the joint following all recommendations in this manual.
- Check to ensure the drive socket is fully seated and locked into position before connecting power to the tool.

Prepare to resist the tool's torque reaction:

Start the tool by depressing the start lever or trigger.

Release start lever after the cycle is complete.

3.5.1 Directional Control

WARNING

UNEXPECTED REACTION FORCES
To Avoid Injury:
- Be prepared – when a tool operates in reverse, the tool's torque reaction is opposite to the reaction produced when the tool operates in forward direction.
- The tool can have a higher initial reaction force when loosening a fastener.
- Always stop the tool before changing direction of spindle rotation.

3.5.2 Torque Reaction Devices

WARNING

PINCH POINT BETWEEN TORQUE REACTION BAR AND WORK PIECE
To Avoid Injury:
- Never place any body part between a reaction bar and the work piece.
- Before starting the tool, position the reaction bar firmly against a stationary rigid member that is opposite to the spindle rotation.

Torque reaction devices absorb tool torque reaction forces. Always use reaction devices when high reaction force could injure an operator.

Some reaction devices may require modification to fit the application. Follow all appropriate installation instructions.

3.5.3 Tool Temperature

W A R N I N G

POTENTIAL BURN HAZARD
Fixtured tools have higher operating temperatures and do not have additional thermal protection.
To Avoid Injury:
Wear thermal protective gloves when handling fixtured tools.

Stanley electric tools are thermally protected to prevent overheating. Temperature is sensed inside the tool, either in the motor windings of E series or on the resolver board on EA tools and the value is reported to the controller. The thermal protection does not allow the tool to operate if the tool temperature raises abnormally – the thermal protector resets automatically when the tool cools down. The maximum tool temperature before damage occurs is 150°C.

EN60745-1 Hand-Held Motor-Operated Electric Tools - Safety is the most applicable standard to the E and EA series tools. It defines +60°C as the limit for thermal rise over ambient of a contactable surface (e.g. if the ambient is 25°C, the surface limit is 85°C.) Since the default limit is 85°C inside the tool regardless of ambient, no external surface can exceed this value no matter what the ambient temperature.

Stanley Assembly allows the temperature limit adjustment to provide flexibility to the professional user. Once a customer changes the setting from the factory default, it is their responsibility to ensure the safety of the user.

Controller parameter settings can have a significant effect on tool operating temperatures.

3.5.4 Tool Status Lights

Handheld tools from **STANLEY ASSEMBLY TECHNOLOGIES** have three (green, yellow, and red) status lights. The status light mirror or copy the status lights on the controller or control panel.

Green	Tightened to specified limits	The tightening cycle meets all of the specified parameters.
Yellow	Low torque or angle	The tightening cycle was rejected for not achieving either low torque or low angle.
Red	High torque or angle	The tightening cycle was rejected for exceeding either high torque or high angle.
All lights	Reverse	The next time the start trigger is engaged the tool will remove the fastener.

3.5.5 Setting Torque, Angle, and Other Operating Parameters

W A R N I N G

EXCESSIVE TORQUE CONDITION
To Avoid Injury:
- Only trained and qualified personnel should program controllers.
- Never set control limits above the maximum rating of the tool.
- Setting control limits above the maximum rating of the tool can cause high reaction torque.
- Always test for proper tool operation after programming the controller.

The Alpha controller can be setup to change tightening Jobs or Tasks from the tool's MFB.

3.6 Special Application Tools

3.6.1 Exposed Gear Socket Tools

W A R N I N G

PINCH POINT AT THE EXPOSED GEARS OR TEETH
To Avoid Injury:
Keep body parts and clothing away from the exposed gear sockets. Dress properly. Do not wear loose-fitted clothing or jewelry.

Exposed gear socket tools are designed to fit into tight spaces where other tools do not fit. These tools have exposed gears or ratchet teeth. It is recommended to use the ARMING feature for these types of tools.

3.6.2 Tubenut Nutrunners

W A R N I N G

PINCH POINT AT THE EXPOSED GEARS OR TEETH
To Avoid Injury:
- Never place body parts or clothing, near the socket opening. Dress properly. Do not wear loose-fitted clothing or jewelry.
- Follow the Tubenut Nutrunner Sequence of Operation

Tubenut nutrunners are used for installing tube fittings.

Tubenut Sequence of Operation (QPM Tools)

- Place nutrunner socket on fastener
- Press the MFB to “arm” the start function
- Depress start lever
- The tool stops after reaching torque
- Release the lever and lift the tool from the fastener, all tool status lights flash to indicate the tool will now run in reverse to open the socket
- Depress the start lever until the socket returns to the open position
- Release the lever
- Remove the tool

Alpha Controller Connections

Each controller or Alpha Controller has a different combination of connectors. These connectors serve several purposes, such as:

- Power
- Tool Connections
- Discrete inputs and outputs

C A U T I O N

POTENTIAL ELECTROSTATIC DISCHARGE HAZARD AND WATER AND DIRT INGESTION
To Avoid Damage:
If not using a connector, keep the connector securely covered with the provided cap. This reduces the opportunity for transfer of static electricity and prevents dirt and water from entering the controller.

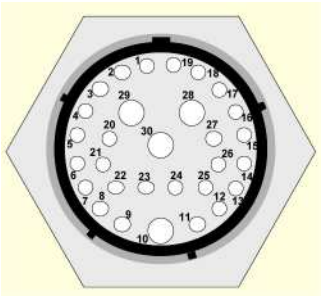
4.1 Alpha Controller Connections

4.1.1 Alpha Controller Power Cord

Alpha Controllers use an IEC 60320 style connector. The power source connector for the power cord is based on customer requirements. The power cord should be rated at either 15A/125V for 115 V or 10A/250V for 230 V use of the controller.

4.1.2 Alpha Controller Tool Connector

Alpha controllers use a single 30 pin connector to connect two types of QPM DC electric tool cables. QPM E__ DC electric tool cables use a MIL-C-38999 Series III connector. The connector is a 17-30S with the insert clocked in the normal position (30-pin Tool Connector). QPM EA DC electric tools use a similar connecter except for B clocking.

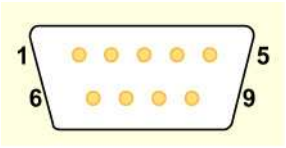


30-pin Tool Connector

4.1.3 Alpha Controller Serial Connector

Alpha controllers have two male DB-9 connectors. The setup is 9600-baud rate, 8 data bits, No Parity and 1 Stop bit, and is not programmable. The connection between the computer and the controller is a simple null-modem cable.

The one that is labeled COM PORT 1 has the intended purpose of connecting a laptop computer for access to Embedded Toolbox software. Other communication functions can be selected for the serial port besides Embedded Toolbox. Those choices are Barcode/Printer, Barcode or Printer.



DB-9 Connector Pins

Pin	Function	Pin	Function	Pin	Function
1	Carrier Detect	4	Data Terminal Ready	7	Request to Send
2	Receive Data	5	Signal Ground	8	Clear to Send
3	Transmit Data	6	Data Set Ready	9	Ring Indicator

A second DB-9 connector COM PORT 2 is available if needed. It also has options for different communication functions. The list includes:

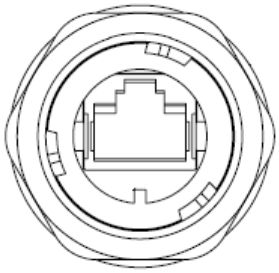
- Barcode/Printer – This reads a barcode scanner and prints the fastening cycles after they occur; see string below.
- Barcode – This only reads a barcode scanner.
- Printer – This only prints after a fastening cycle occurs; see string below.
- PFCS – Use this to connect to a Chrysler PFS system.
- Toyota – Use this to connect to a Toyota PI box.
- Open – Use this to connect to an Open protocol serial network.

```
S01,JB01,  4.1,A,126.2,A,A,06/09/2008 10:20:19,                                  ,
  |    |     | |     | | |  |  |    |  |  |  |                                  |
  |    |     | |     | | |  |  |    |  |  |  |                               barcode
  |    |     | |     | | |  |  |    |  |  |  second                    (32 characters)
  |    |     | |     | | |  |  |    |  |  minute
  |    |     | |     | | |  |  |    |  hour
  |    |     | |     | | |  |  |    year
  |    |     | |     | | |  |  day
  |    |     | |     | | |  month
  |    |     | |     | | overall status (A=OK, R=NOK)
  |    |     | |     | angle status (A=OK, H=HIGH, L=LOW)
  |    |     | |     angle result (last step ran or audit step whichever is smaller, fixed decimals)
  |    |     | torque status (A=OK, H=HIGH, L=LOW)
  |    |     torque result (last step ran or audit step whichever is smaller, decimals are tool/units dependant)
  |    job number
  spindle number (1=MASTER, 2=SLAVE)
```

The barcode input monitors inter-character timing. When there is a 500ms gap between characters, a complete barcode is assumed. When received, the controller logs it with all fastening cycles until another barcode is received or until the controller power is cycled. If the incoming barcode is longer than 32 characters, then the last 32 characters received are used.

4.1.4 Alpha Controller Ethernet Connector

Alpha controllers have a single RJ-45 Ethernet connection located on the bottom of the module for connecting to an Ethernet network. This network can consist of the controller and a PC or a plant-wide fastening network. An optional second Ethernet connector is available to provide connections to two separate networks. The networks are not, and cannot be, connected internally.



The following Ethernet ports are used for the various protocols of the controller:

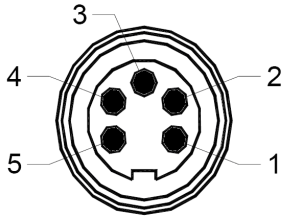
Port	Use	Listen/Transmit	Internet Protocol	Description
13	ICMP	Listen	TCP/IP	ICMP timestamp request
14	ICMP	Transmit	TCP/IP	ICMP timestamp reply
21	FTP	Listen	TCP/IP	User/Password required
23	TELNET	Listen/transmit	TCP/IP	Fastening cycle data printed after each fastening cycle, no login response
80	HTTP	Listen/transmit	TCP/IP	Browser access to the embedded web server for configuration and analysis; browser can use port proxy.
502	ModbusTCP	Listen/transmit	TCP/IP	ModbusTCP I/O traffic
2000	ETB	Listen	TCP/IP	Parameter server for Embedded Toolbox
2222	EthernetIP I/O	Listen	TCP/IP	EthernetIP I/O traffic
3414	Stanley	Listen/transmit	TCP/IP	Link between Stanley devices
4545	OPEN	Listen/transmit	TCP/IP	OPEN protocol traffic; port is assignable by end user.
4700	XML Command	Listen	TCP/IP	XML commands to controller
4710	XML Result	Transmit	TCP/IP	XML response from controller
6547	Toolsnet	Listen/Transmit	TCP/IP	Toolsnet protocol traffic; port is assignable by end user.
8786	PLC	Listen/Transmit	TCP/IP	ARD/AWT; PLC read and write
44818	EthernetIP Messaging	Listen	TCP/IP	EthernetIP messaging traffic

The Alpha controller listens on the ports specified but transmits on any available port to the port specified of the target computer.

4.1.5 Alpha Controller (Model QA1001 _D_) Slave DeviceNet™ Connector

Alpha controllers can have a single Mini DeviceNet™ port for connecting the Alpha Controller to a master controller such as a PLC.

Pin	Slave
1	Drain
2	V+
3	V-
4	CAN H
5	CAN L



Alpha Controllers Mini DeviceNet™ Connector

4.1.6 Alpha Controller (Model QA1001 _P_) Profibus Port

Alpha Controllers can have a single Profibus port for connecting the Alpha Controller to a master Profibus controller from another manufacturer.

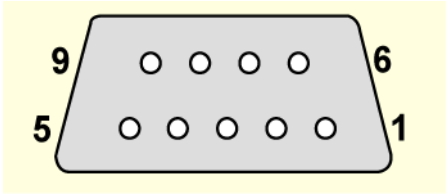


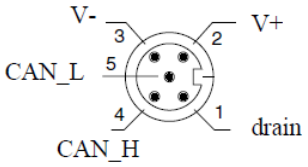
Figure 4-1 DB-9 Connecter Pins (Profibus Port)

Pin	Function	Pin	Function	Pin	Function
1	Empty	4	Repeater	7	Blank
2	Empty	5	Data Ref	8	Data Line Inverse
3	Data Line	6	Power Supply	9	Empty

4.1.7 Alpha Controller (Model QA1001 M__) Master DeviceNet Connector

Alpha controllers can have a single Micro DeviceNet™ port for connecting peripheral devices to the Alpha Controller as a master controller. The assignable I/O and the embedded PLC can be programmed to run the peripheral devices.

Pin	Master
1	Drain
2	V+
3	V-
4	CAN H
5	CAN L



Alpha Controllers Micro DeviceNet™ Connector

4.1.8 Alpha Controller (Model QA1001 __V) Input and Output Connector

All eight inputs and eight outputs are optically isolated 24VDC. The Alpha has an internal 24VDC power supply that can be used to provide the I/O signals; an external 24VDC power supply may be used instead. The following are amperage ratings:

- Internal 24 VDC supply: Maximum = 1 ampere total
- External 24 VDC supply: Maximum = 1 ampere per output

The Alpha controller's Input circuits conform to the IEC 61131-2 standard for PLCs.

LIMITS per IEC 61131-2

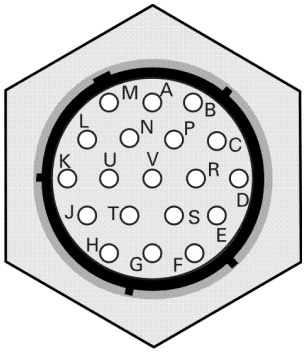
Rated Voltage	Type Of Limit	Type 2 limits					
		State 0		Transition		State 1	
		V low (v)	I low (ma)	V trans (v)	I trans (ma)	V high (v)	I high (ma)
24 volt	Max	5	30	11	30	30	30
	Min	-3	ND	5	2	11	6

The Alpha controller has a MIL-C-26482 Series I plug connector with cable clamp and solder cup pins.

NOTE:
One I/O mating connector (P/N 21C104800) is included with each Alpha controller. Optional crimp style mating connectors, crimp tools, round connector-to-terminal strip and pig-tail I/O cables are also available.

Part No.	19-pin 24V I/O Port	Included
21C104800	Mating Connector - Solder pins	Standard
21C104802	Mating Connector - Crimp pins	Optional
21C104804	Mating Connector - Crimp pins, crimp tool	Optional
21E102202	Breakout Box for plinth mounting	Optional
21C202005	I/O Cable 5M	Optional
21C202010	I/O Cable 10M	Optional
21C202020	I/O Cable 20M	Optional

21C2020XX schematic



When the Alpha controller is used with fixtured tools, it must use a Remote Start/Stop/Reverse pendent to the controller to provide basic switching control for the tool.

Pin descriptions are shown in the following table:

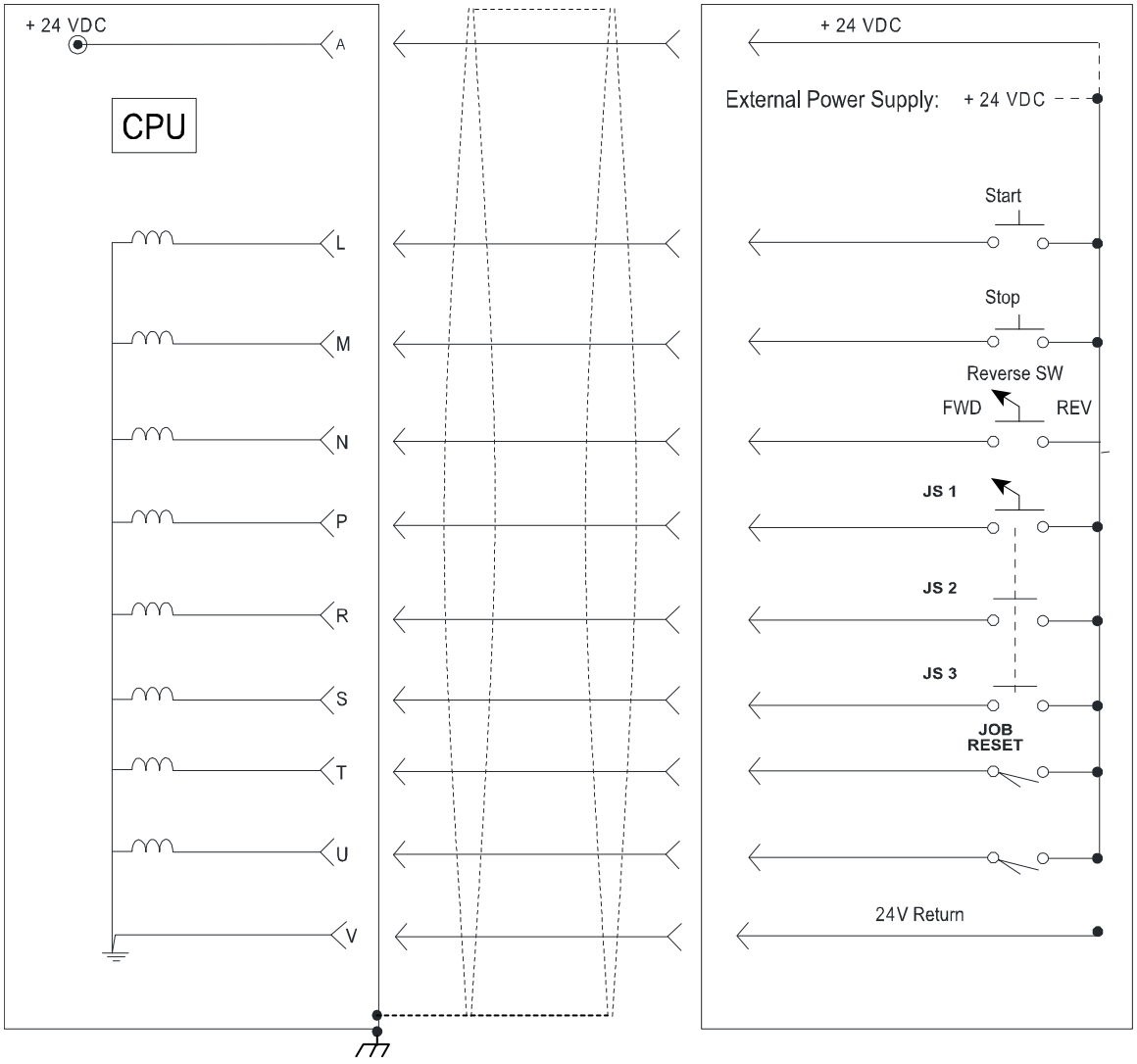
Pin #	Description	PLC Address
C	Output	O:0.0/0
D	Output	O:0.0/1
E	Output	O:0.0/2
F	Output	O:0.0/3
G	Output	O:0.0/4
H	Output	O:0.0/5
J	Output	O:0.0/6
K	Output	O:0.0/7
A	24 VDC	N/A
B	Output Supply	N/A

Pin #	Description	PLC Address
L	Input	I:0.0/0
M	Input	I:0.0/1
N	Input	I:0.0/2
P	Input	I:0.0/3
R	Input	I:0.0/4
S	Input	I:0.0/5
T	Input	I:0.0/6
U	Input	I:0.0/7
V	24 VDC Return	N/A

Schematics of the Inputs, Outputs and other pins, with cabling, are shown below:

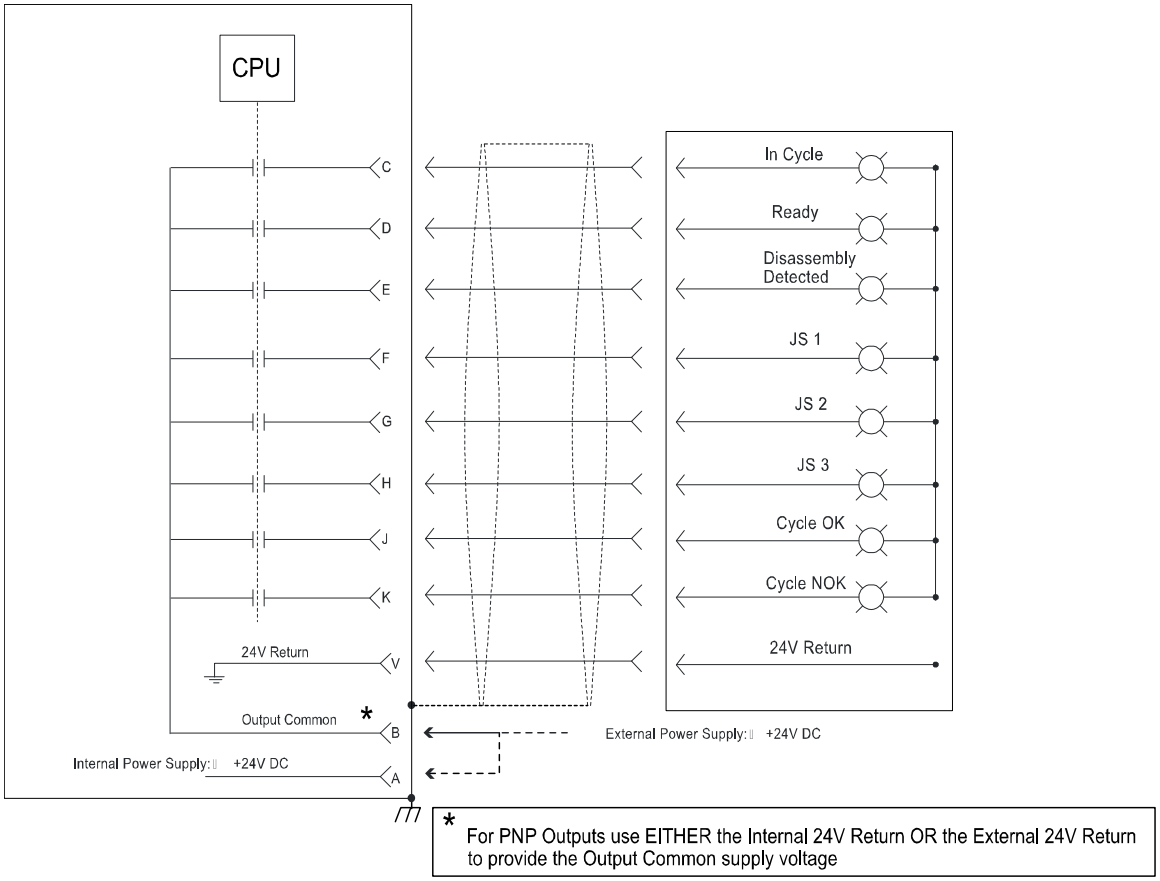
Inputs

(example)



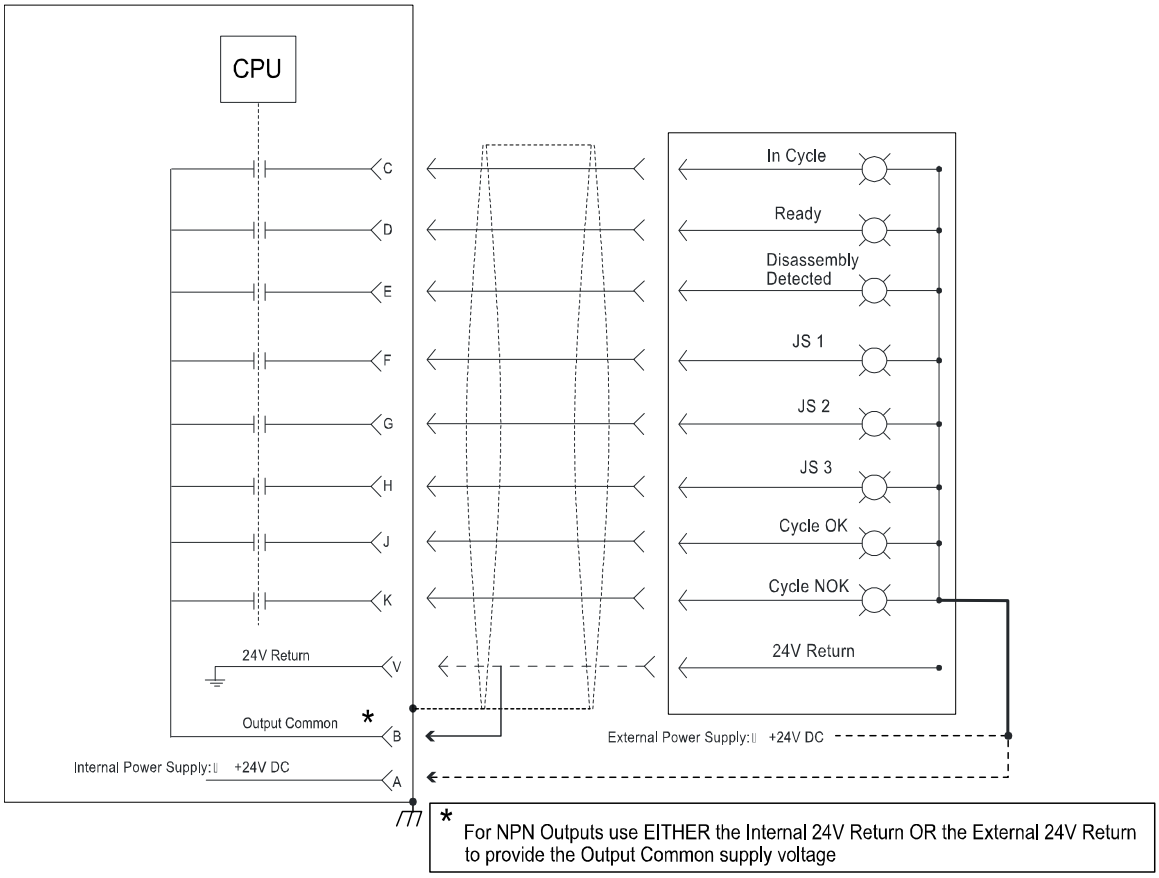
Outputs: Sourcing

(example)



Outputs: Sinking

(example)



4.2 Assignable Input and Output Elements

The following Input/Output (I/O) elements apply to the 24 VDC I/O connector. There is a maximum of eight inputs and eight outputs for the 24 VDC I/O connector. There is a maximum of 512 bytes of input and 512 bytes of output on each type of Fieldbus used with the controller (except DeviceNet with a limit of 256 bytes for both inputs and outputs). Ninety-nine is the maximum number of I/O elements that can be assigned to each Fieldbus input or output. Each I/O element can have a length of 1 to 32 bits. You must keep track of the lengths for each I/O element you assign to stay within the maximum length of the Fieldbus you are using.

More than one Fieldbus connection can be used at the same time. For instance, the Alpha controller can use the 24 VDC I/O connector AND Modbus/TCP on Ethernet AND DeviceNet all at the same time. If more than one type of Input uses a particular element, the controller responds to an input when an element is asserted on any one of those inputs.

It is important to understand how the Alpha controller, and the internal PLC, responds to the rising and falling edges of input elements as they are asserted or removed, not while the levels are high or low. The STOP bit is an exception; it is a true OR function rather than working off the transition. One type of Input does not have priority over the other. The controller responds to the first *change* in status of an input element, no matter which Fieldbus connection makes the change.

If more than one Fieldbus shares a particular output function, that function is asserted on all shared Fieldbuses.

The table below lists the available input and output elements, gives a brief description and indicates the configuration options for each. The configuration options are an important aspect of the I/O elements, as they add powerful, multiple dimensions to each element not previously seen in Stanley tool controllers. These new dimensions allow integration of these controllers in unique ways, providing an amazing amount of flexibility.

Alpha Controller

Please see the full description of each element in the section following this table.

Inputs	Description	Configuration Options
IGNORE	Input is not used	Input is not assigned
START	Start the tool	N.O./N.C., Latch, Timer
SELECT JOB	Select a job	N.O./N.C., Job, Disable when open
SELECT TASK	Select a task	N.O./N.C., Task, Disable when open
STOP	Stop the tool	N.O./N.C.
RESET JOB	Reset a job	N.O./N.C.
TASK SELECT BIT	One bit in a series to select the task	N.O./N.C., Bit
JOB SELECT BIT	One bit in a series to select the job	N.O./N.C., Bit
REVERSE	Put the tool in reverse	N.O./N.C.
DISABLE TASK	Disable the task	N.O./N.C., Task
DISABLE JOB	Disable the job	N.O./N.C., Job
TASK VERIFY	Verify the selected task to the inputs	N.O./N.C., Task
JOB VERIFY	Verify the selected job to the inputs	N.O./N.C., Job
TASK VERIFY BIT	Verify the selected task to one of the input bits in a series	N.O./N.C., Bit
JOB VERIFY BIT	Verify the selected job to one of the input bits in a series	N.O./N.C., Bit
RESET RESULT STATUS	Clear the result status	N.O./N.C.
REVERSE START	Put the tool in reverse and start the tool	N.O./N.C.
DISABLE TOOL	Disable tool (will complete running if it is in cycle)	N.O./N.C.
*PART ID	Sets the part identification	Length, Trigger
*PART ID TRIGGER	Trigger for PART ID/Resets PART ID CHANGED output.	N.O./N.C.
SYNC IN	Other Alpha is finished with current step	N.O./N.C.
SYNC RESUME	Start the next step in the strategy	N.O./N.C.

* Input not available on 24V

Outputs	Description	Configuration Options
NOT USED	Output is not in use	None
IN CYCLE	The tool is in cycle	N.O./N.C., Type, Time
JOB SELECTED	Indicates a specific job is selected	N.O./N.C., Type, Time, Job
DISASSEMBLY DETECTED	A tightened fastener removed has been loosened	N.O./N.C., Type, Time
TOOL RUNNING	The tool is running	N.O./N.C., Type, Time
CYCLE OK	Fastening cycle was OK	N.O./N.C., Type, Time
CYCLE NOK	Fastening cycle was NOK	N.O./N.C., Type, Time
TASK SELECTED	Indicates a specific task is selected	N.O./N.C., Type, Time, Task
JOB COMPLETE	Job complete (all bolts in job are OK)	N.O./N.C., Type, Time, Job
TASK COMPLETE	Task complete (all bolts in task are OK)	N.O./N.C., Type, Time, Task
TASK SELECTED BIT	A bit to indicate the selected task in a series of bits	N.O./N.C., Bit, Mode
JOB SELECTED BIT	A bit to indicate the selected job in a series of bits	N.O./N.C., Bit, Mode

Inputs	Description	Configuration Options
TORQUE OK	Fastening cycle Torque was within limits	N.O./N.C., Type, Time, Step
TORQUE HIGH	Fastening cycle Torque exceeded High limit	N.O./N.C., Type, Time, Step
TORQUE LOW	Fastening cycle Torque under Low limit	N.O./N.C., Type, Time, Step
ANGLE OK	Fastening cycle Angle was within limits	N.O./N.C., Type, Time, Step
ANGLE HIGH	Fastening cycle Angle exceeded High limit	N.O./N.C., Type, Time, Step
ANGLE LOW	Fastening cycle Angle under Low limit	N.O./N.C., Type, Time, Step
CYCLE ABORTED	The fastening cycle was aborted/stopped	N.O./N.C., Type, Time
STOPPED	A STOP input is asserted	N.O./N.C., Type, Time
FAULTED	A fault condition is active	N.O./N.C., Type, Time
READY	The tool is ready to run	N.O./N.C., Type, Time
PM	The tool requires service	N.O./N.C., Type, Time
*TORQUE	Torque result value	Format, Step
*ANGLE	Angle result value	Format, Step
*FAULT CODE	Fault code value	Format
*PARAMETER	Parameter number	Format, Step
START TRIGGER	Shows the state of the tool trigger	N.O./N.C., Type, Time
MFB	Shows the state of the multifunction button	N.O./N.C., Type, Time
SNUG ACHIEVED	Is set when Snug torque exceeded	N.O./N.C., Type, Time
CYCLE STOPPPED	Shut off code is STOP	N.O./N.C., Time
*PART ID CHANGED	Controller has received a new PART ID	N.O./N.C., Type, Time
STEP BIT	Indicates last step of fastening cycle in a series of bits	N.O./N.C., Bit, Mode
SYNC OUT	Alpha is finished with current step	N.O./N.C., Type, Time
*BOLT COUNT	Active Accumulated Bolt Count	Format
*RUNDOWN YEAR	Year of last fastening cycle	Format
*RUNDOWN MONTH	Month of last fastening cycle	Format
*RUNDOWN DAY	Day of last fastening cycle	Format
*RUNDOWN HOUR	Hour of last fastening cycle	Format
*RUNDOWN MINUTE	Minute of last fastening cycle	Format
*RUNDOWN SECOND	Second of last fastening cycle	Format
*RUNDOWN JOB	Job of last fastening cycle	Format
*RUNDOWN TASK	Task of last fastening cycle	Format
*PART ID	Active PART ID	Format
*CONSTANT	User defined value	Format
*RUNDOWN BOLT	Accumulated Bolt Count of last fastening cycle	Format
*RUNDOWN UNITS	Torque Units of last fastening cycle	Format
*RUNDOWN STATUS	Overall status of last fastening cycle	Format
*RUNDOWN TORQUE STATUS	Torque status of last fastening cycle	Format
*RUNDOWN ANGLE STATUS	Angle status of last fastening cycle	Format

* Outputs not available on 24 VDC

4.2.1 Input Descriptions

Each of the single bit input elements has a Configuration setting of Contact Type. The Contact Type can be Normally Open (N.O.) or Normally Closed (N.C.). If an input's contact type is normally open, the input is asserted when 24 VDC is applied to the 24 VDC connector input pin, or when the fieldbus bit transitions from low to high. If an input's contact type is normally closed, the input is asserted when 24 VDC is removed from the 24 VDC connector input pin, or when the fieldbus bit transitions from high to low.

The Input elements assert on the transition only.

Job or Task selection can come from multiple inputs at once, including the MFB. There is no priority, each one is equal. The Alpha controller switches its active Job or Task with each input change. The last one to change becomes the active Job or Task.

Inputs	Description
IGNORE	The input is not used. This is a placeholder. For fieldbus, the length of this input function may be set to any size that meets the need.
START	When asserted, on any input type, the tool starts and runs the currently selected job/task. This input is overridden by the STOP input. If STOP is used and a tool restart is required, remove the STOP, remove the START, then re-assert the START. If the tool is required to operate in Disassembly mode, remove the START, assert the REVERSE input, and then re-assert the START. When removed, from any type of Input, the tool stops. Even if a second START input is active, the tool stops when any START is removed. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Latch: This is applicable to external inputs only. This is not applicable to the trigger on the tool handle. Yes – Causes the START input to latch internally after a time period has elapsed. The physical START input can be removed without stopping the tool. The tool runs until all steps in the active task are complete or time out. A TIME parameter is available to set how long the START input must be applied, in seconds, before the Latch becomes active. No – The Latch function is off.
SELECT JOB	When asserted, on any input type, the controller makes this input's Job the active Job. When removed either nothing happens or if "Disable when open" is selected as yes, then the tool becomes disabled. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Job: Type the job number to select when this input is asserted. Disable when open: Yes – Disables the tool when this input is removed. No – Does not disable the tool upon input removal.
SELECT TASK	When asserted, on any input type, the controller makes this input's Task the active Task. When removed either nothing happens or if "Disable when open" is selected as yes, then the tool becomes disabled. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Task: Type the Task number to select when this input is asserted. Disable when open: Yes – Disables the tool when this input is removed. No – Does not disable the tool upon input removal.

Inputs	Description
STOP	When asserted, on any input type, the controller stops the tool. It also prevents the tool from running while it is applied. When removed nothing happens other than the tool runs. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.)
RESET JOB	When asserted, on any input, the controller resets the accumulated bolt count to zero for the active job and acts as a Part Entry to re-enable the tool if disabled. The tool could be disabled due to "Error Proofing" and the accumulated bolt count equal to target bolt count. When removed nothing happens. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.)
TASK SELECT BIT	When asserted or removed, on any input type, the controller selects a Task. This is one bit, in a series of bits, to create a binary number. The number created by this and other TASK SELECT BITs determines which the active task for the tool becomes. More than one input assigned as a TASK SELECT BIT creates a number greater than one. The maximum number of tasks required determines the maximum number of these inputs. In binary numbers, the digit furthest to the right is the *ones* digit. The next digit to the left is the *twos* digit, next is the *fours* digit, then the *eights* digit, and so on. The integer equivalent to a binary number can be found by summing all the weighted values of the selected digits. For example, the binary number 10101 is equivalent to the integer 21. The math is 1 + 4 + 16 = 21: the high digits (one) are added together and the low digits (zero) are ignored. **Bit Number** **4** 3 **2** 1 **0** **Weighted Value** **16** 8 **4** 2 **1** **Binary Number** **1** 0 **1** 0 **1** **24 VDC Pins (example)** R P N M L To select task #21 on the controller at least five inputs are assigned as TASK SELECT BIT. Each would then be given a bit number to have a series of bits with different weighted values. For example, on the 24 VDC input pin L is bit 0, pin M is bit 1, pin N is bit 2, pin P is bit 3, and pin R is bit 4. Therefore, to select task #21, assert pins L, N and R. Size: 1 bit, except on fieldbus where it can be any size to fit the need. Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Bit: Type the number of this bit, in the binary number scheme, to select tasks. Mode: All TASK SELECT BITs must be the same mode, no mixing of modes allowed. Binary – Creates a decimal number equivalent to the weighted value of this binary bit(s). Binary + 1 – Creates a number equivalent to the weighted value of this binary bit(s) and adds the value of one (1) to that number.
JOB SELECT BIT	When asserted or removed on any input type, the controller selects a job. This is one bit, in a series of bits, to create a binary number. See TASK SELECT BIT function description for explanation of this bit (note that this references Jobs not Tasks). Size: 1 bit, except on fieldbus where it can be any size to fit the need. Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Bit: Type the number of this bit, in the binary number scheme, to select jobs. Mode: All JOB SELECT BITs must be the same mode, modes cannot be mixed. Binary – Creates a decimal number equivalent to the weighted value of this binary bit(s). Binary + 1 – Creates a number equivalent to the weighted value of this binary bit(s) and adds the value of one (1) to that number.

Inputs	Description
REVERSE	When asserted on any input type, the tool is placed in Reverse (disassembly) mode. This does NOT run the tool in Reverse mode, it changes the tool mode from Forward to Reverse. If one input is required to do both functions, see REVERSE START. When removed, from any input type, the controller places the tool into Forward (assembly) mode. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.)
DISABLE TASK	When asserted on any input type, the tool is disabled while this specific task is selected. This acts like a STOP to stop the tool during use. Use the Task parameter under Configuration to select the disabled task. When removed, the tool will be allowed to run while this specific task is selected. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Task: Type the task number to disable when this input is asserted.
DISABLE JOB	When asserted on any input type, the controller disables the tool while this specific job is selected. This acts like a STOP to stop the tool during use. Use the JOB parameter under Configuration to select the job to be disabled while this input is asserted. When removed the tool will be allowed to run while this specific job is selected. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Job: Type the job number to select when this input is asserted.
TASK VERIFY	When asserted on any input type, the controller verifies the selected and active task is equal to this input's task. Use the TASK parameter under Configuration to select the task number to verify. If the wrong task is selected the tool is disabled. When removed, verification will not happen. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Task: Type the task number to verify when this input is asserted.
JOB VERIFY	When asserted on any input type, the controller verifies the selected and active job is equal to this input's job. Use the JOB parameter under Configuration to select the job number to verify. If the wrong job is selected the tool is disabled. When removed, verification will not happen. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Job: Type the job number to verify when this input is asserted.
TASK VERIFY BIT	When asserted on any input type, the controller verifies the selected and active task is equal to this input's task. Use the BIT parameter under Configuration to select the task number to verify. If there is a mismatch between the active task and the selected task the tool is disabled. This is one bit of a binary number created by many of these bits. See TASK SELECT BIT to understand how to use bits to create binary numbers. When removed verification will not happen. Size: 1 bit, except on fieldbus where it can be size any size to fit the need. Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Bit: Type the number this bit will be in the binary number scheme to verify a task. Mode: All TASK VERIFY BITs must be the same mode, no mixing of modes allowed. Binary – Creates a decimal number equivalent to the weighted value of this binary bit(s). Binary + 1 – Creates a number equivalent to the weighted value of this binary bit(s) and add the value of one (1) to that number.

Inputs	Description
JOB VERIFY BIT	When asserted on any input type, the controller verifies the selected and active job is equal to this input's job. Use the BIT parameter under Configuration to select the job number to verify. If there is a mismatch between the active job and the selected job the tool is disabled. This is one bit of a binary number created by many of these bits. See TASK SELECT BIT to understand how to use bits to create binary numbers. When removed verification will not happen. Size: 1 bit, except on fieldbus where it can be any size to fit the need. Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Bit: Type the number this bit to be in the binary number scheme to verify a job. Mode: All JOB VERIFY BITs must be the same mode, no mixing of modes allowed. Binary – Creates a decimal number equivalent to the weighted value of this binary bit(s). Binary + 1 – Creates a number equivalent to the weighted value of this binary bit(s) and add the value of one (1) to that number.
RESET RESULT STATUS	When asserted on any input type, the controller resets to 0 (zero) any fastening cycle results status output bit on the same type of I/O. Meaning, if asserted on DeviceNet, only the DeviceNet output status bits are reset. Output status bits on other types of I/O will remain in their original state. The list of status bits that will reset are: CYCLE OK CYCLE NOK TORQUE OK TORQUE HIGH TORQUE LOW ANGLE OK ANGLE HIGH ANGLE LOW CYCLE ABORTED CYCLE STOP When removed nothing happens. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.)
REVERSE START	When asserted on any input type, the tool mode is switched to Reverse (Disassembly) AND the tool is started. This is different from the REVERSE input function in that the REVERSE input function puts the tool into Reverse mode only. When removed the tool stops and switch back to Forward mode. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.)
DISABLE TOOL	When asserted on any input type, the controller prevents the tool from running. It does NOT stop the tool if the tool is running, but prevents it from running when the next START signal is applied. The START input can come from any type of I/O or the tool trigger. When removed the tool is allowed to run after the next START input. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.)

Inputs	Description
*PART ID TRIGGER	When asserted on any fieldbus input type, the PART ID CHANGED output goes high. This input function is NOT available on the 24 VDC type of I/O. This lets the PLC program know the controller has read the new PART ID. See PART ID input function for an explanation of the handshake between controller and external PLC. When removed, the PART ID CHANGED output goes low. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.)
*PART ID	When asserted on any fieldbus input type, the controller reads the new PART ID input and places the data into the Part ID buffer. This is added to the fastening cycle data and stored in the controller or sent out via the serial or Ethernet port. This input function is NOT available on the 24 VDC type of I/O. Size: Can be any size from 0 to 32 bytes. When removed nothing happens. Configuration: Length: Type the length of the expected data string in bits. Trigger: Manual: A handshake must be performed in order for the controller to read the new PART ID. The definition of a handshake is as follows: 1. The external PLC verifies the PART ID CHANGED output is low (0). 2. The external PLC writes the data into the PART ID fieldbus input. 3. The controller reads the PART ID data into its memory and sets the PART ID CHANGED output to high (1), indicating the data has been read. 5. The PLC reads the high level on the PART ID CHANGED output then sets the PART ID TRIGGER input to high (1). 6. The controller sets the PART ID CHANGED output to low (0). 7. The external PLC sets the PART ID TRIGGER input to low (0). Auto: The controller reads the PART ID automatically when it changes, no handshake required.
SYNC IN	When asserted on any input type, the controller sets an internal bit and waits for the active step to end. When the controller is synchronized, and both conditions are met, it energizes the SYNC OUT output indicating to the next controller in line that all controllers upstream are finished with the current step. When removed nothing happens. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.)
SYNC RESUME	When asserted on any input type, the controller turns off the SYNC OUT output and starts the next step in the multi-step strategy. When removed nothing happens. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.)

* Outputs not available on 24 VDC

4.2.2 Output Descriptions

Each of the output elements has Configuration settings: Contact types, Output types and others. It is recommended to configure them immediately once the output elements are assigned to a pin.

Contact Type

The Contact Type can be Normally Open (N.O.) or Normally Closed (N.C.).

Sourcing Outputs (PNP type)

If an output's contact type is normally open and the output is asserted, the output pin transitions from 0VDC to 24VDC. If an output's contact type is normally closed and the output is asserted, the output pin transitions from 24VDC to 0VDC.

Sinking Outputs (NPN type)

If an output's contact type is normally open and the output is asserted, the output pin transitions from 24VDC to 0VDC. If an output's contact type is normally closed and the output is asserted, the output pin transitions from 0VDC to 24VDC.

Output Type

The Output Type defines the behavior of the output signal.

Normal – The output asserts and stays asserted until a reset condition occurs.

Minimum On Time – Keeps the output asserted for this minimum time in seconds, even though a reset condition occurs. After the timer is finished, the output resets if a reset condition has occurred, otherwise it remains asserted until a reset condition occurs.

Timed – The output asserts for this period of time, then resets on its own without waiting for the reset condition to occur.

Time – Units are in seconds.

Flash – The output flashes for as long as it is asserted.

Period – Sets the flashing On and Off times, which are equal. Units are in seconds

Outputs	Description
NOT USED	The output is not used. This is essentially a placeholder. For fieldbus, the length of this input function may be set to any size that meets the need.
IN CYCLE	Asserts during the fastening cycle when the achieved torque value exceeds the Threshold Torque value. Resets when the fastening cycle has ended. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period
JOB SELECTED	Asserts when a job is selected by any means. Resets when the active job is complete. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Job: Type the job number that, when selected, asserts this output. Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period
DISASSEMBLY DETECTED	Asserts when the tool is running in Reverse and the achieved torque value exceeds the Threshold Torque value through some rotation. Resets when the tool is stopped. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period

Outputs	Description
TOOL RUNNING	Asserts anytime the tool is energized. Resets when the tool is commanded to stop. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period
CYCLE OK	Asserts at the end of a fastening cycle when the achieved torque and angle for the Audit step are within specified limits. Will not assert if the Stop/Abort within Limits parameter is set to *Yes* and the tool is stopped or aborted within limits. Resets when the tool is commanded to run again. Can also be reset with the RESET RESULTS STATUS input. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period
CYCLE NOK	Asserts at the end of a fastening cycle when the achieved torque and/or angle for the Audit step are NOT within specified limits. Also asserts when the Stop/Abort within Limits parameter is set to *Yes* and the tool is stopped or aborted within limits. Resets when the tool is commanded to run again. Can also be reset with the RESET RESULTS STATUS input. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period
TASK SELECTED	Asserts when a task is selected by any means. Resets when the active task is complete. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Task: Type the task number that, when selected, asserts this output. Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period
JOB COMPLETE	Asserts when a job is completed (accumulated bolt count equals target bolt count). Resets when a different job is selected or when the input RESET JOB is asserted. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period
TASK COMPLETE	Asserts when a task is complete (all bolts assigned to task are OK). Resets when a task is selected. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Task: Type the task number that, when completed, asserts this output. Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period

Outputs	Description
TASK SELECTED BIT	Asserts when required to indicate the active task. This is one bit in a series of bits to create a binary number. As tasks change so will the binary number created from these bits. Size: 1 bit, except on fieldbus where it can be any size to fit the need. Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Bit: Type the number this bit will be in the binary number scheme for selected tasks. Mode: All TASK SELECTED BITs must be the same mode, no mixing of modes allowed. Binary – Creates a decimal number equivalent to the weighted value of this binary bit(s). Binary + 1 – Creates a number equivalent to the weighted value of this binary bit(s) and add the value of one (1) to that number.
JOB SELECTED BIT	Asserts when required to indicate the active job. This is one bit in a series of bits to create a binary number. As jobs change so will the binary number created from these bits. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Bit: Type the number this bit to be in the binary number scheme for selected jobs. Mode: All JOB SELECTED BITs must be the same mode, modes cannot be mixed. Binary – Creates a decimal number equivalent to the weighted value of this binary bit(s). Binary + 1 – Creates a number equivalent to the weighted value of this binary bit(s) and adda the value of one (1) to that number.
TORQUE OK	Asserts at the end of a fastening cycle when the achieved torque value is within limits for the Audit step. Resets when the tool is commanded to start again. Can also be reset with the RESET RESULTS STATUS input. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Step: Audit, Audit-1, Audut-2 Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period
TORQUE HIGH	Asserts at the end of a fastening cycle when the achieved torque value is above the High Torque limit for the Audit step. Resets when the tool is commanded to start again. Can also be reset with the RESET RESULTS STATUS input. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Step: Audit, Audit-1, Audut-2 Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period

Outputs	Description
TORQUE LOW	Asserts at the end of a fastening cycle when the achieved torque value is below the Low Torque limits Audit step. Resets when the tool is commanded to start again. Can also be reset with the RESET RESULTS STATUS input. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Step: Audit, Audit-1, Audut-2 Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period
ANGLE OK	Asserts at the end of a fastening cycle when the achieved angle value is within limits for the Audit step. Resets when the tool is commanded to start again. Can also be reset with the RESET RESULTS STATUS input. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Step: Audit, Audit-1, Audut-2 Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period
ANGLE HIGH	Asserts at the end of a fastening cycle when the achieved angle value is above the High Angle limit for the Audit step. Resets when the tool is commanded to start again. Can also be reset with the RESET RESULTS STATUS input. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Step: Audit, Audit-1, Audut-2 Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period
ANGLE LOW	Asserts at the end of a fastening cycle when the achieved angle value is below the Low Angle limits for the Audit step. Resets when the tool is commanded to start again. Can also be reset with the RESET RESULTS STATUS input. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Step: Audit, Audit-1, Audut-2 Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period
CYCLE ABORTED	Asserts when the controller shuts the tool off due to a fault or if the Stop/Abort within Limits parameter is used and the fastening cycle has a shutoff code of ABORT. Resets when the tool is commanded to run again. Can also be reset with the RESET RESULTS STATUS input. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period

Outputs	Description
STOPPED	Asserts when the STOP input is received, or anytime the tool is stopped. See section 2.5.6 Stop Tool Operation. Resets when the STOP input or the Stop Tool Operation is reset. The ⊠ icon is on when this output is on. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period
FAULTED	Asserts when there is a fault on the controller. Resets when the fault clears. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period
READY	Asserts when there is no fault on the controller and the tool is ready to run. This output resets when the tool is disabled and the ⊠ icon is on the screen. See section 2.4.6 Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period
PM	Asserts when the Preventive Maintenance Count in the tool's memory has exceeded the Preventive Maintenance Threshold. Resets when the Preventive Maintenance Count is reset to zero. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period
*TORQUE	This output is the peak achieved torque value during the fastening cycle from the Audit step. It asserts when the fastening cycle is complete (before the IN CYCLE bit resets). The value resets to zero (0) when the tool is commanded to run again. Size: Can be any size from 0 to 32 bytes depending on Data Type Data Type: Float, Int8, Int16, Int32, Fixed Point, String Step: Audit, Audit-1, Audit-2
*ANGLE	This output is the peak achieved angle value during the fastening cycle from the Audit step. It asserts when the fastening cycle is complete (before the IN CYCLE bit resets). The value resets to zero (0) when the tool is commanded to run again. Size: Can be any size from 0 to 32 bytes depending on Data Type Data Type: Float, Int8, Int16, Int32, Fixed Point, String Step: Audit, Audit-1, Audit-2

Outputs	Description
*FAULT CODE	This output is the number value of the fault code present in the controller. It asserts when a fault is active and resets when the fault clears. The values are as follows: 1 - Overcurrent Fault! 2 - Logic Voltage Fault! 3 - Position Feedback Fault! 4 - Transducer Span Fault! 5 - Temperature Fault! 6 - Unrecognized Tool! 7 - Tool Communications! 8 - Transducer Current Fault! 9 - Transducer Zero Fault! 10 - Unused 11 - Unused 12 - Unused 13 - Unsupported Tool! Size: Can be any size from 0 to 32 bytes depending on Data Type Data Type: Float, Int8, Int16, Int32, Fixed Point, String
*PARAMETER	This output is the value of the selected Parameter. It changes when the parameter changes. Size: Can be any size from 0 to 32 bytes depending on Data Type Data Type: Float, Int8, Int16, Int32, Fixed Point, String Parameter: Target Torque, High Torque, Low Torque, Target Angle, High Angle, Low Angle, Snug Torque, Speed, Step Name, Torque Cal, Tool Serial Number, Torque Bailout, Angle Bailout, Downshift Torque, Downshift Speed, Tool Model Number, Step: Audit, Audit-1, Audit-2
START TRIGGER	Asserts when the tool's trigger is pressed. Resets when the tool trigger is released. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period
MFB	Asserts when the tool's Multi-function Button is pressed. Resets when the Multi-function Button is pressed again. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period
SNUG ACHIEVED	Asserts at the end of a fastening cycle if the achieved torque value exceeds the Snug Torque value during the fastening cycle. Resets when the tool is commanded to run again. Can also be reset with the RESET RESULTS STATUS input. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Step: Audit, Audit-1, Audut-2 Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period

Outputs	Description
CYCLE STOP	Asserts when the tool shuts off due to a loss of Start signal or the operator released the trigger before the target was achieved. Resets when the tool is commanded to run again. Can also be reset with the RESET RESULTS STATUS input. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period
*PART ID CHANGED	This output works in conjunction with PART ID and PART ID TRIGGER inputs. Read the PART ID input section for an understanding of this output element. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period
STEP BIT	Asserts at the end of the fastening cycle to indicate the last step ran. This is one bit, in a series of bits, to create a binary number. Size: 1 bit, except on fieldbus where it can be any size to fit the need. Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Bit: Type the number this bit will be in the binary number scheme for steps. Mode: All STEP BITs must be the same mode, no mixing of modes allowed. Binary – Creates a decimal number equivalent to the weighted value of this binary bit(s). Binary + 1 – Creates a number equivalent to the weighted value of this binary bit(s) and add the value of one (1) to that number.
SYNC OUT	Asserted when the controller has finished a synchronized step and the SYNC IN input is asserted. Resets when the SYNC RESUME input is asserted. Size: 1 bit Configuration: Contact Type: Normally Open (N.O.), Normally Closed (N.C.) Output Type: Normal, Timed, Flash Minimum ON Time, Time, Period
*BOLT COUNT	This output is the value of the active accumulated bolt count. As the bolt count changes so does this output. Size: Can be any size from 0 to 32 bytes depending on Data Type Data Type: Float, Int8, Int16, Int32, Fixed Point, String String: Length: Number of Decimal Positions: Pad Character: Delimiter:
*RUNDOWN YEAR	This is the year value of the last fastening cycle date. It asserts when the fastening cycle is complete (before the IN CYCLE bit resets). The value resets to zero (0) when the tool is commanded to run again. Size: Can be any size from 0 to 32 bytes depending on Data Type Data Type: Float, Int8, Int16, Int32, Fixed Point, String

Outputs	Description
*RUNDOWN MONTH	This is the month value of the last fastening cycle date. It asserts when the fastening cycle is complete (before the IN CYCLE bit resets). The value resets to zero (0) when the tool is commanded to run again. Size: Can be any size from 0 to 32 bytes depending on Data Type Data Type: Float, Int8, Int16, Int32, Fixed Point, String
*RUNDOWN DAY	This is the day value of the last fastening cycle date. It asserts when the fastening cycle is complete (before the IN CYCLE bit resets). The value resets to zero (0) when the tool is commanded to run again. Size: Can be any size from 0 to 32 bytes depending on Data Type Data Type: Float, Int8, Int16, Int32, Fixed Point, String
*RUNDOWN HOUR	This is the hour value of the last fastening cycle time. It asserts when the fastening cycle is complete (before the IN CYCLE bit resets). The value resets to zero (0) when the tool is commanded to run again. Size: Can be any size from 0 to 32 bytes depending on Data Type Data Type: Float, Int8, Int16, Int32, Fixed Point, String
*RUNDOWN MINUTE	This is the minute value of the last fastening cycle time. It asserts when the fastening cycle is complete (before the IN CYCLE bit resets). The value resets to zero (0) when the tool is commanded to run again. Size: Can be any size from 0 to 32 bytes depending on Data Type Data Type: Float, Int8, Int16, Int32, Fixed Point, String
*RUNDOWN SECOND	This is the second value of the last fastening cycle time. It asserts when the fastening cycle is complete (before the IN CYCLE bit resets). The value resets to zero (0) when the tool is commanded to run again. Size: Can be any size from 0 to 32 bytes depending on Data Type Data Type: Float, Int8, Int16, Int32, Fixed Point, String
*RUNDOWN JOB	This value indicates the job in which the last fastening cycle was performed. It asserts when the fastening cycle is complete (before the IN CYCLE bit resets). The value resets to zero (0) when the tool is commanded to run again. Size: Can be any size from 0 to 32 bytes depending on Data Type Data Type: Float, Int8, Int16, Int32, Fixed Point, String
*RUNDOWN TASK	This value indicates the task in which the last fastening cycle was performed. It asserts when the fastening cycle is complete (after the IN CYCLE bit resets). The value resets to zero (0) when the tool is commanded to run again. Size: Can be any size from 0 to 32 bytes depending on Data Type Data Type: Float, Int8, Int16, Int32, Fixed Point, String
*PART ID	This value is equal to and changes as the PART ID input changes. Size: Can be any size from 0 to 32 bytes depending on Data Type Data Type: Float, Int8, Int16, Int32, Fixed Point, String
*CONSTANT	This value is defined by the end user in the Constant parameter. It asserts when the fastening cycle is complete (after the IN CYCLE bit resets). The value resets to zero (0) when the tool is commanded to run again. Size: Can be any size from 0 to 32 bytes depending on Data Type Data Type: Float, Int8, Int16, Int32, Fixed Point, String Constant: Type the value of the constant required
*RUNDOWN BOLT	This is the accumulated bolt count value of the last fastening cycle. It asserts when the fastening cycle is complete (after the IN CYCLE bit resets). The value resets to zero (0) when the tool is commanded to run again. Size: Can be any size from 0 to 32 bytes depending on Data Type Data Type: Float, Int8, Int16, Int32, Fixed Point, String

Outputs	Description
*RUNDOWN UNITS	This is the numeric equivalent value of the torque units of the last fastening cycle. It asserts when the fastening cycle is complete (after the IN CYCLE bit resets). The value resets to zero (0) when the tool is commanded to run again. The numeric equivalent values are: 0 – Newton Meters 1 – Ftlbs 2 – inlbs 3 – inoz 4 – KgM 5 – KgCm 6 – Newton Decimeters Size: Can be any size from 0 to 32 bytes depending on Data Type Data Type: Float, Int8, Int16, Int32, Fixed Point, String
*RUNDOWN STATUS	This output will be one of two selections. The selections are the User Defined Value for the associated status of the last fastening cycle. For example: if the last fastening cycle status was OK, and the User Defined Value for OK is *Good*, then this output value is *Good*. The OK User Defined Value asserts at the end of a fastening cycle when the achieved torque and angle for the Audit step are within specified limits. The NOK User Defined Value asserts at the end of a fastening cycle when the achieved torque and angle for the Audit step are NOT within specified limits. The value resets to zero (0) when the tool is commanded to run again. Size: Can be any size from 0 to 32 bytes depending on Data Type Data Type: Float, Int8, Int16, Int32, Fixed Point, String OK: User Defined Value NOK: User Define Value
*RUNDOWN TORQUE STATUS	This output will be one of three selections. The selections are the User Defined Value for the associated torque status of the last fastening cycle. For example: if the last fastening cycle's torque status was High, and the User Defined Value for High is +, then this output value is +. The OK User Defined Value is selected when the achieved torque for the defined step are within specified limits. The Low User Defined Value is selected cycle when the achieved torque for the defined Step is below the Low Torque limit. The High User Defined Value is selected when the achieved torque for the defined step is above the High Torque limit. It asserts when the fastening cycle is complete (before the IN CYCLE bit resets). The value resets to zero (0) when the tool is commanded to run again. Size: Can be any size from 0 to 32 bytes depending on Data Type Data Type: Float, Int8, Int16, Int32, Fixed Point, String OK: User Defined Value Low: User Defined Value High: User Defined Value Step: Audit, Audit-1, Audit-2

Outputs	Description
*RUNDOWN ANGLE STATUS	This output will be one of three selections. The selections are the User Defined Value for the associated angle status of the last fastening cycle. For example: if the last fastening cycle's angle status was Low, and the User Defined Value for Low is -, then this output value is-. The OK User Defined Value is selected when the achieved angle for the defined Step are within specified limits. The Low User Defined Value is selected when the achieved angle for the defined Step is below the Low Angle limit. The High User Defined Value is selected when the achieved angle, for the defined Step, is above the High Angle limit. It asserts when the fastening cycle is complete (before the IN CYCLE bit resets). The value resets to zero (0) when the tool is commanded to run again. Size: Can be any size from 0 to 32 bytes depending on Data Type Data Type: Float, Int8, Int16, Int32, Fixed Point, String OK: User Defined Value Low: User Defined Value High: User Defined Value Step: Audit, Audit-1, Audit-2

* Outputs not available on 24 VDC

Embedded PLC

Each Alpha Controller has an internal software PLC. This PLC serves to enhance the integration of the Alpha controller into an end user's plant. The PLC emulates the Allen Bradley SLC-505 controller and uses many of the same layouts, addressing structures and commands. RSLogix500 can be used to program ladder logic for the embedded PLC.

5.1 "Rack" Layout

The Alpha controller's PLC has a 5-slot virtual rack layout. There are some differences between a SLC-505 rack and the Alpha rack. The CPU card does not have its own slot, rather it is taken into account since it is embedded and cannot be changed. The discreet 24 VDC I/O uses the same slot rather than separate input or output "cards".

The virtual rack is filled as follows:

POWER SUPPLY & CPU	24VDC INPUTS & OUTPUTS Optional SLOT #0	Slave Fieldbus (DeviceNet or Profibus) INPUTS & OUTPUTS Optional SLOT #1	ModbusTCP Ethernet Slave INPUTS & OUTPUTS Standard SLOT #2	EthernetIP Ethernet Slave INPUTS & OUTPUTS Standard SLOT #3	Master Fieldbus DeviceNet INPUTS & OUTPUTS Optional SLOT #4

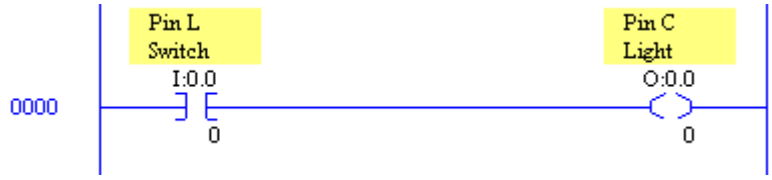
The 24VDC I/O Module in slot 0 reflects the physical I/O on the Alpha.

The Slave Fieldbus card in slot #1 uses the M-12 DeviceNet connector on the bottom of the Alpha when the DeviceNet slave option is ordered. The DB-9 connector is used when Profibus is ordered.
The ModbusTCP card in slot #2 and the EthernetIP card in slot #3 come installed as standard equipment on all Alpha controllers. Each uses the RJ45 Ethernet jack on the bottom of the Alpha. The optional DeviceNet Master Scanner card in slot #4 can be configured to auto-map the devices connected to it. This card uses the M-5 DeviceNet connector on the bottom of the Alpha if this option is ordered.

5.1.1 Addressing Scheme

Use the following syntax when programming to reference any input or output:
Type: Slot#.Word/Bit Type can be Input *I* or Output *O*.

For example, if a switch was wired to Pin L, a light was wired to Pin C and logic was required to turn on the light when the switch was turned on, the logic and addressing would look like this:



As ASCII it would be: SOR XIC I:0.0/0 OTE 0.0/0 EOR

See section 4.1.8 Alpha Controller (Model QA1001 __V) Input and Output Connector for 24VDC Connector PLC addressing.

5.2 Supported Instructions and File Types

See Table 1 and Table 2 for a listing of supported instructions and file types.

NOTE:
The Alpha controller supports only one ladder in the program file. Jump commands are not supported so all logic must be performed in one ladder.

Table 1 Supported Instructions

Instruction	Descriptions	Instruction	Descriptions	Instruction	Descriptions
ABS	Absolute	CTU	Count Up	NXB	Next Branch
ACI	String to Integer	DIV	Divide	OR	OR
ACL	ASCII Clear Buffer	END	Program End	OSR	One-Shot Rising
ACN	String Concatenate	EOR	End of Rung	OTE	Output Energize
ADD	Add	EQU	Equal	OTL	Output Latch
AEX	String Extract	GEQ	Greater Than or Equal	OUT	Output Unlatch
AIC	Integer to String	GRT	Greater Than	RES	Reset
AND	And	LEQ	Less Than or Equal	RTO	Retentive Timer
ARD	ASCII Read Characters	LES	Less Than	SOR	Start of Rung
ASC	String search	LIM	Limit Test	SUB	Subtract
ASR	ASCII String Compare	MEQ	Masked Comparison for Equal	TOF	Timer Off-Delay
AWT	ASCII Write	MOV	Move	TON	Timer On-Delay
BND	Branch End	MUL	Multiply	XIC	Examine if Closed
BST	Branch Start	MVM	Masked Move	XIO	Examine if Open
CLR	Clear	NEG	Negate	XOR	Exclusive OR
COP	Copy	NEQ	Not Equal		
CTD	Count Down	NOT	Not		

Table 2 Supported Files

O0	OUTPUT
I1	INPUT
B3	BINARY
T4	TIMER
C5	COUNTER
R6	CONTROL
N7	INTEGER
ST14	STRING

Instructions	Description
ABS	Absolute Calculates the absolute value of the source and places the result in the destination.
ACI	String to Integer Use the ACI instruction to convert a numeric ASCII string to an integer value between -32,768 and 32,767.
ACL	ASCII Clear Buffer Clears the send and/or the receive buffers.
ACN	String Concatenate Combines two strings using ASCII strings as operands. The second string is appended to the first and the result stored in the destination.

Instructions	Description
ADD	Use the ADD instruction to add one value (source A) to another value (source B) and place the result in the destination.
AEX	String Extract Use the AEX instruction to create a new string by taking a portion of an existing string and moving it to the new string. Enter the following parameters when programming this instruction. • Source is the existing string. The source value is not affected by this instruction. • Index is the starting position (from 1 to 82) of the string to extract (an index of 1 indicates the left-most character of the string). • Number is the number of characters (from 1 to 82) to extract (startis at the indexed position). If the index plus the number is greater than the total characters in the source string, the destination string will be the characters from the index to the end of the source string. • Destination is the string element (ST14:X) where the extracted string is stored.
AIC	Integer to String Converts an integer value, between -32,768 and 32,767, to an ASCII string.
AND	Performs a bit-by-bit logical AND. The operation is performed using the value at source A and the value at source B. The result is stored in the destination.
ARD	ASCII read characters Performs a read from a source channel and moves the value into a destination string. Provides a Result integer for the status of the read. Channel 0 = Serial port Channel 1 = Screen Channel 2 = Ethernet port 8786
ASC	String Search Use the ASC instruction to search an existing string for an occurrence of the source string. Enter the following parameters when programming this instruction: • Source is the string you want to find when examining the search string. • Index is the starting position (from 1 to 82) of the source string. (An index of 1 indicates the left-most character of the string.) • Search is the string you want to examine. • Result is an integer where the processor stores the position of the search string where the source string begins. If no match is found, result is set equal to zero.
ASR	ASCII String Compare Use the ASR instruction to compare two ASCII strings. The system looks for a match in length and upper/lower case characters. If two strings are identical, the rung is true; if there are any differences, the rung is false.
AWT	ASCII Write Writes a source string to the designated channel. Provides a Result integer for the status of the write. Channel 0 = Serial port Channel 1 = Screen, limited to 3 lines and 99 characters. 33 characters per line. Use \n to create a new line. Channel 2 = Ethernet port 8786
BND	Branch End Marks the end of branches on a rung.
BST	Branch Start Marks the beginning of a new branch on a rung.
CLR	Clear Sets the value of a destination word to zero.

<table>
<tr><th>Instructions</th><th>Description</th></tr>
<tr><td>COP</td><td>Copy
Copies blocks of data from one location to another.
• Source is the address of the file to copy.
• Destination is the starting address where the instruction stores the copy.
• Length is the number of elements in the file to copy.</td></tr>
<tr><td>CTD</td><td>Count Down
Counts false-to-true rung transitions.
When rung conditions for a CTD instruction have made a false-to-true transition, the accumulated value is decremented by one count, provided that the rung containing the CTD instruction is evaluated between these transitions.
The accumulated counts are retained when the rung conditions again becomes false. The accumulated count is retained until cleared by a reset (RES) instruction that has the same address as the counter reset.
<table>
<tr><th>This Bit</th><th>Is Set When</th><th>And Remains Set Until One of the Following</th></tr>
<tr><td>Count Down Underflow Bit OV (Bit 11)</td><td>Accumulated value wraps around to +32,768 from -32,767</td><td>A RES instruction having the same address as the CTD instruction is executed OR the count is incremented greater than or equal to +32,767 with a CTU instruction</td></tr>
<tr><td>Done Bit DN (Bit 13)</td><td>Accumulated value is equal to or greater than the preset value</td><td>The accumulated value becomes less than the preset value</td></tr>
<tr><td>Count Down Enable Bit CU (Bit 14)</td><td>rung conditions are true</td><td>Rung conditions go false or a RES instruction having the same address as the CTD instruction is enabled</td></tr>
</table></td></tr>
<tr><td>CTU</td><td>Count Up
Counts false-to-true rung transitions.
When rung conditions for a CTU instruction have made a false-to-true transition, the accumulated value is incremented by one count, provided that the rung containing the CTU instruction is evaluated between these transitions.
The accumulated value is retained when the rung conditions again become false. The accumulated count is retained until cleared by a reset (RES) instruction that has the same address as the counter reset.
The count value must remain in the range of -32768 to 32767. If the count value goes above 32767 the overflow (OV) bit is set. If the count value goes below -32768, the counter status underflow (UN) bit is set. A counter can be reset to zero using the reset (RES) instruction.
<table>
<tr><th>This Bit</th><th>Is Set When</th><th>And Remains Set Until One of the Following</th></tr>
<tr><td>Count Up Overflow Bit OV (Bit 12)</td><td>Accumulated value wraps around to -32,768 from +32,767</td><td>A RES instruction having the same address as the CTU instruction is executed OR the count is decremented less than or equal to +32,767 with a CTD instruction</td></tr>
<tr><td>Done Bit DN (Bit 13)</td><td>Accumulated value is equal to or greater than the preset value</td><td>The accumulated value becomes less than the preset value</td></tr>
<tr><td>Count Up Enable Bit CU (Bit 15)</td><td>Rung conditions are true</td><td>Rung conditions go false or a RES instruction having the same address as the CTU instruction is enabled</td></tr>
</table></td></tr>
<tr><td>DIV</td><td>Divide
Use the DIV instruction to divide one value (source A) by another (source B). The rounded quotient is then placed in the destination. If the remainder is 0.5 or greater, round up occurs in the destination. The unrounded quotient is stored in the most significant word of the math register. The remainder is placed in the least significant word of the math register.</td></tr>
<tr><td>END</td><td>Program End
Marks the end of the program.</td></tr>
<tr><td>EOR</td><td>End of Rung
Marks the end of a rung.</td></tr>
</table>

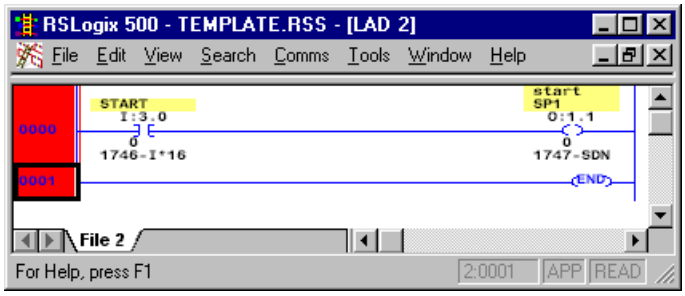
Instructions	Description
EQU	Equal Use the EQU instruction to test whether two values are equal. If source A and source B are equal, the instruction is logically true. If these values are not equal, the instruction is logically false.
GEQ	Greater than or Equal Use the GEQ instruction to test whether one value (source A) is greater than or equal to another (source B). If the value at source A is greater than or equal to the value at source B, the instruction is logically true. If the value at source A is less than the value at source B, the instruction is logically false.
GRT	Greater Than Use the GRT instruction to test whether one value (source A) is greater than another (source B). If the value at source A is greater than the value at source B, the instruction is logically true. If the value at source A is less than or equal to the value at source B, the instruction is logically false.
LEG	Less Than or Equal Use the LEQ instruction to test whether one value (source A) is less than or equal to another (source B). If the value at source A is less than or equal to the value at source B, the instruction is logically true. If the value at source A is greater than the value at source B, the instruction is logically false.
LES	Less Than Use the LES instruction to test whether one value (source A) is less than another (source B). If source A is less than the value at source B, the instruction is logically true. If the value at source A is greater than or equal to the value at source B, the instruction is logically false.
LIM	Limit Test Use the LIM instruction to test for values within or outside a specified range, depending on how limits are set. If the Low Limit has a value equal to or less than the High Limit, the instruction is true when the Test value is between the limits or is equal to either limit. If the Test value is outside the limits, the instruction is false.
MEQ	Masked Comparison for Equal Use the MEQ instruction to compare data at a source address with data at a compare address. Use of this instruction allows portions of the data to be masked by a separate word. The source is the address of the value to compare. The mask is the address of the mask through which the instruction moves data. The mask can also be a hexadecimal value (constant). The compare is an integer value or the address of the reference. If the 16 bits of data at the source address are equal to the 16 bits of data at the compare address (less masked bits), the instruction is true.
MOV	Move This output instruction moves the source value to the destination location. As long as the rung remains true, the instruction moves the data each scan.
MUL	Multiply Use the MUL instruction to multiply one value (source A) by another (source B) and place the result in the destination.
MVM	Masked Move The MVM instruction is a word instruction that moves data from a source location to a destination, and allows portions of the destination data to be masked by a separate word. As long as the rung remains true, the instruction moves the data each scan.
NEG	Negate Use the NEG instruction to change the sign of the source and then place it in the destination. The destination contains the two's complement of the source.
NEQ	Not Equal Use the NEQ instruction to test whether two values are not equal. If source A and source B are not equal, the instruction is logically true. If the two values are equal, the instruction is logically false.
NOT	This instruction performs a bit-by-bit logical NOT. The operation is performed using the value at source A. The result (one's complement of A) is stored in the destination.
NXB	Next Branch Marks the beginning of another branch.

<table>
<tr><th>Instructions</th><th>Description</th></tr>
<tr><td>OR</td><td>This instruction performs a bit-by-bit logical OR. The operation is performed using the value at source A and the value at source B. The result is stored in the destination.</td></tr>
<tr><td>OSR</td><td>One Shot Rising
The OSR instruction is a retentive input instruction that triggers an event to occur one time. Use the OSR instruction when an event must start based on the change of state of the rung from false-to-true.
When the rung conditions preceding the OSR instruction go from false-to-true, the OSR instruction will be true for one scan. After one scan is complete, the OSR instruction becomes false, even if the rung conditions preceding it remain true. The OSR instruction will only become true again if the rung conditions preceding it transition from false-to-true.
The address assigned to the OSR instruction is not the one-shot address referenced by the program, nor does it indicate the state of the OSR instruction. This address allows the OSR instruction to remember its previous rung state.</td></tr>
<tr><td>OTE</td><td>Output Energize
Use the OTE instruction in the ladder program to turn on a bit when rung conditions are evaluated as true.</td></tr>
<tr><td>OTL</td><td>Output Latch
OTL is a retentive output instruction. OTL can only turn on a bit (while OTU can only turn off a bit). This instruction is usually used in pair with the OTU instruction. The program can examine a bit controlled by OTL instructions as often as necessary.
When rung conditions become false (after being true), the bit remains set and the corresponding output remains energized.
When enabled, the latch instruction tells the controller to turn on the addressed bit. Thereafter, the bit remains on, regardless of the rung condition, until the bit is turned off (typically by an OTU instruction in another rung).</td></tr>
<tr><td>OTU</td><td>Output Unlatch
OTU is a retentive output instruction. OTU can only turn off a bit (while OTL can only turn on a bit). This instruction is usually used in pairs with the OTL instruction. The program can examine a bit controlled by the OTU instruction as often as necessary.
The unlatch instruction tells the controller to turn off the addressed bit. Thereafter, the bit remains off, regardless of the rung condition, until it is turned on (typically by an OTL instruction in another rung).</td></tr>
<tr><td>RES</td><td>Reset
Use a RES instruction to reset a timer or counter. When the RES instruction is enabled, it resets the Timer On Delay (TON), Retentive Timer (RTO), Count Up (CTU) or Count Down (CTD) instruction having the same address as the RES instruction.</td></tr>
<tr><td>RTO</td><td>Retentive Timer
Use the RTO instruction to turn an output on or off after its timer has been on for a preset time interval. The RTO instruction is a retentive instruction that begins to count millisecond intervals when rung conditions become true. The RTO instruction retains its accumulated value when the rung conditions become false. The Time Base must be 10 msec. The timer will not work in any other Time Base.
<table>
<tr><th>This Bit</th><th>Is Set When</th><th>And Remains Set Until One of the Following</th></tr>
<tr><td>Timer Done Bit DN (Bit 13)</td><td>accumulated value is equal to or greater than the preset value</td><td>the appropriate RES instruction is enabled</td></tr>
<tr><td>Timer Timing Bit TT (Bit 14)</td><td>rung conditions are true and the accumulated value is less than the preset value</td><td>Rung conditions go false or when the done bit is set</td></tr>
<tr><td>Timer Enable Bit EN (Bit 15)</td><td>rung conditions are true</td><td>rung conditions go false or if the timer is reset with the RES instruction</td></tr>
</table></td></tr>
<tr><td>SOR</td><td>Start of Rung
Marks the beginning of a new rung.</td></tr>
<tr><td>SUB</td><td>Subtract
Use the SUB instruction to subtract one value (source B) from another (source A) and place the result in the destination.</td></tr>
</table>

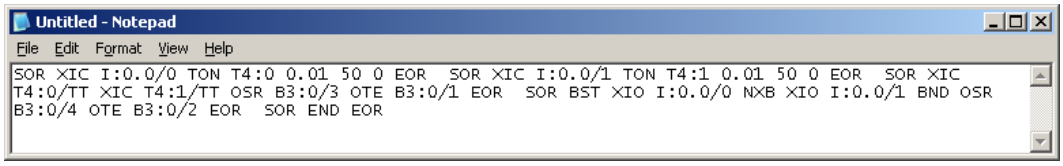
<table>
<tr><th>Instructions</th><th>Description</th></tr>
<tr><td>TOF</td><td>Timer Off Delay
Use the TOF instruction to turn an output on or off after its rung has been off for a preset time interval. The TOF instruction begins to count millisecond intervals when the rung makes a true-to-false transition. As long as rung conditions remain false, the timer increments its accumulated value (ACC) each millisecond until it reaches the preset value (PRE). The accumulated value is reset when rung conditions go true regardless of whether the timer has timed out. The Time Base must be 10 msec. The timer will not work in any other Time Base.
<table>
<tr><th>This Bit</th><th>Is Set When</th><th>And Remains Set Until One of the Following</th></tr>
<tr><td>Timer Done Bit DN (Bit 13)</td><td>rung conditions are true</td><td>rung conditions go false and the accumulated value is greater than or equal to the preset value</td></tr>
<tr><td>Timer Timing Bit TT (Bit 14)</td><td>rung conditions are false and the accumulated value is less than the preset value</td><td>rung conditions go true or when the done bit is reset</td></tr>
<tr><td>Timer Enable Bit EN (Bit 15)</td><td>rung conditions are true</td><td>rung conditions go false</td></tr>
</table></td></tr>
<tr><td>TON</td><td>Timer On Delay
Use the TON instruction to turn an output on or off after the timer has been on for a preset time interval. The TON instruction begins to count millisecond intervals when rung conditions become true. As long as rung conditions remain true, the timer adjusts its accumulated value (ACC) each evaluation until it reaches the preset value (PRE). The accumulated value is reset when rung conditions go false, regardless of whether the timer has timed out. The Time Base must be 10 msec. The timer will not work in any other Time Base.
<table>
<tr><th>This Bit</th><th>Is Set When</th><th>And Remains Set Until One of the Following</th></tr>
<tr><td>Timer Done Bit DN (bit 13)</td><td>accumulated value is equal to or greater than the preset value</td><td>rung conditions go false</td></tr>
<tr><td>Timer Timing Bit TT (bit 14)</td><td>rung conditions are true and the accumulated value is less than the preset value</td><td>rung conditions go false or when the done bit is set</td></tr>
<tr><td>Timer Enable Bit EN (bit 15)</td><td>rung conditions are true</td><td>rung conditions go false</td></tr>
</table></td></tr>
<tr><td>XIC</td><td>Examine If Closed
Use the XIC instruction in the ladder program to determine if a bit is on. When the instruction is executed, if the bit addressed is on (1), then the instruction is evaluated as true. When the instruction is executed, if the bit addressed is off (0), then the instruction is evaluated as false.</td></tr>
<tr><td>XIO</td><td>Examine If Open
Use the XIO instruction in the ladder program to determine if a bit is off. When the instruction is executed, if the bit addressed is off (0), then the instruction is evaluated as true. When the instruction is executed, if the bit addressed is on (1), then the instruction is evaluated as false.</td></tr>
<tr><td>XOR</td><td>Exclusive Or
Performs a bit-by-bit logical Exclusive Or. The operation is performed using the value at source A and the value at source B. The result is stored in the destination.</td></tr>
</table>

5.3 Converting the File

After designing the ladder logic program using RSLogix 500 as an editor, the information must then be converted to a format recognized by the Alpha. First highlight all the rungs from top to bottom, then select Copy from the Edit menu.



Paste the information into a text file by launching Notepad, then selecting Paste from the Edit menu. RSLogix adds characters to certain addresses which are carried over to the paste operation. The Alpha controller does not support these added characters. They must be removed or converted to the appropriate address before saving the file for use in the Alpha. See section 5.3.1 Invalid Characters.

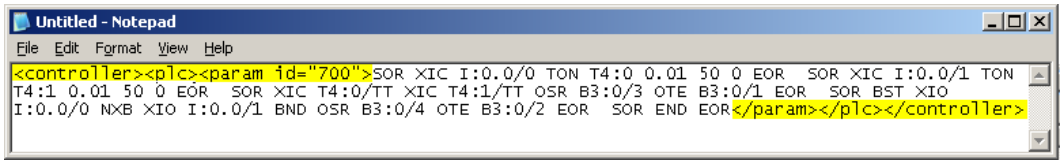


This must now be converted to an XML file. Type the following BEFORE the first SOR in the pasted logic in Notepad:

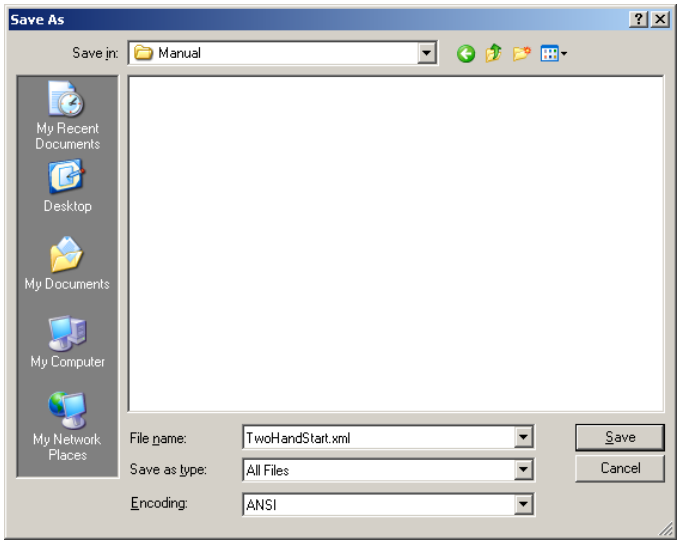
<controller><plc><param id="700">

Then type the following AFTER the last EOR in the pasted logic in Notepad:

</param></plc></controller>



Save the file using the .xml extension and choose “All Files” under *Save as type* in the Save window.



Once the file is saved it can be put into the Alpha controller. See section 2.9.3.10 PLC Tab.

5.3.1 Invalid Characters

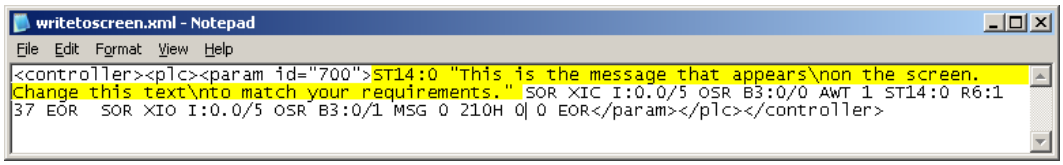
When the logic refers to a specific word in a string file it uses DATA[X], where X is the referenced word. The Alpha controller does not support the DATA[X] syntax. This must be converted to a number. For example, if the word referred to is ST14:3.DATA[5] then this must be

converted to ST14:3.6 in the Notepad file. DATA[5] refers to word six in the string. The Alpha controller must be given the word number not the DATA[X] number. The X value in DATA[X] is always one less than the word number referenced in the string.

RSLogix can also substitute one address for a value. When this happens it puts a pound sign (#) in front of the address. The Alpha controller does not support this pound sign. Find another way to program without using substitutions.

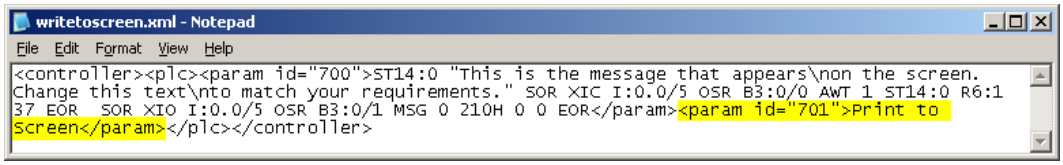
5.3.2 Predefining String or Integer Files

To use predefined strings or integers, type the string or integer file address and its value before the logic in the Notepad file. There must be a space between the address and the value. For Strings, the value must be encapsulated within double quotes. There must be a space after the string or integer value and before the first SOR command.



5.3.3 Applying a Name and Version

The name, as it appears on the screen of the Alpha, can be different from the file name given. To provide a display name, put another XML parameter tag after </param> tag and before the </plc></controller> ending tags. The new tag will be <param id=”701”>NAME</param>. There is a 15 character limit to this parameter. This is active in Alpha controller version QA1-3.4.1 or higher.



To provide a display version, put another XML parameter tag after </param> tag and before the </plc></controller> ending tags. The new tag will be <param id=”702”>VERSION</param>. There is a 15 character limit to this parameter.

Glossary

Abort Timer	The tightening cycle aborts if the tool does not shutoff before this pre-selected time.
Acceleration	How fast the controller changes the speed of the tool from 0 (stopped) to the rated speed.
Accept Tone	Controls the tone made from the handle of handheld QPM tools for accepted tightening cycles. Allows distinct tones for tools in adjacent workstations.
ATC	Allows Adaptive Tightening Control modes to be selected, so that consistent torque can be maintained over a wide range of joints. Manual downshift should be used when: • High Prevailing Torques – Prevailing Torque > 20% of the Torque Set Point (TSP). • High Starting Torque –Starting Torque > 20% of TSP.
Batch Count	The number of tightening cycles required to be within specified limits to complete a batch. The Run display shows the batch count and number of complete tightening cycles.
Downshift Mode	Disable: no downshift; Manual: Occurs at specified torque; ATC automatically adapts to the joint.
Downshift Speed	Once the tool reaches the Downshift Torque point, the controller changes the operating speed of the tool from the initial Tool Speed to the Downshift Speed.
Downshift Torque	The controller changes the operating speed of the tool from the initial Tool Speed to the Downshift Speed at the Downshift Torque level.
High Angle	Anytime the peak angle recorded exceeds the High Angle, the tightening cycle is recorded as a reject for high angle, the high angle light (red) illuminates and the tightening cycle is given an overall status of NOK.
High Torque	Anytime the peak torque recorded exceeds the High Torque, the tightening cycle is recorded as a reject for high torque, the high torque light (red) illuminates and the tightening cycle is given an overall status of NOK.
Low Angle	Anytime the peak angle recorded during the Angle Audit Step fails to reach the Low Angle, the tightening cycle is recorded as a reject for low angle, the low angle light (yellow) illuminates and the tightening cycle is given an overall status of NOK.
Low Torque	When the peak torque recorded fails to reach the Low Torque, the tightening cycle is recorded as a reject for low torque, the low torque light (yellow) illuminates and the tightening cycle is given an overall status of NOK.
MFP Mode	Controls the operation of the multiple-function panel (MFP) on QPM tools. The choices for handheld tools are Disable, Reverse (Disassembly), Parameter Select, Arming and Reset Reject. The default value is Disable.
PM Counter	Records the number of tightening cycles completed since the last time it was reset for Planned Maintenance.
PM Limit	When the PM Counter exceeds the PM Limit, the controller provides a maintenance alert.
Parameter Set	A Parameter Set is a collection of instructions that define how the tool should perform the tightening process. It may be selected from the keypad or 24V device such as a socket tray.
Reject Tone	Controls the tone made from the handle of handheld QPM tools for rejected tightening cycles. Allows distinct tones for tools in adjacent workstations.
Slow Seek	Slow Seek helps engage the socket or fastener at a pre-selected speed, torque level and angular rotation. Once engaged, the tightening cycle completes at a higher speed. Slow Seek prevents crossthreaded fasteners and previously secured fasteners from being counted in a batch.

Snug Torque	The controller begins to monitor the tool for angle at a preselected threshold torque. Any increase in angle after the snug point results in a corresponding increase in the tension or clamp load within the joint.
Soft Stop	Soft stop minimizes the torque impulse to the operator during tool shutoff at the end of the tightening cycle.
Speed	The speed at which the tool operates during the initial portion of the tightening cycle prior to ATC or downshift.
Spindle	A spindle represents a connection to a hand held or fixtured tool connected to a controller.
Strategy	Identifies what variables will be used to control the tool during a tightening cycle.
Thread Direction	Sets assembly direction to clockwise (CW) or counter clockwise (CCW).
Threshold Torque	Sets the point at which the tool is "In Cycle". When the tool is "In Cycle" the tool and controller tightening cycle status lights turn off, the controller displays dashes (-) for data, and the "In Cycle" output is turned on.
Tool Tones	Distinctive sounds assigned to tool functions.
Torque Calibration	Determines how torque values are assigned to the electrical signals from the torque transducer on the tool. This value is unique to each tool and changes over time.
Torque Target	When the tool is being controlled for torque, the torque target instructs the controller when to shutoff the tool. The torque target should be greater than Low Torque and less than High Torque, and is required for torque control.
Trace	A display plot of torque vs time (or angle) of a tightening cycle.
Trip Counter	Records the number of tightening cycles completed since the last time it was reset. It is usually used as a supplementary count of the PM Counter.
Units	The following torque units and associated labels are used with Stanley controllers and tools. The labels are derived from SP811, *SI Unit rules and style conventions* from the National Institute of Standards and Technology

Abbreviation	**Common Term**	**= 1 lbfft**	**= 1 Nm**
Nm	Newton meter	1.355 818	1
Ncm	Newton centimeter	135.581 8	100
kgm	Kilogram meter	0.138 255 2	0.101 971 6
kgfm	kilogram-force meter		
kgcm	Kilogram centimeter	13.825 52	10.197 16
kgfcm	kilogram-force centimeter		
ft lb	Foot pound	1	0.737 562 1
lbfft	pound-force foot		
in lb	Inch pound	12	8.850 745
lbfin	pound-force inch		
in oz	inch ounce	192	141.611 9
ozfin	ounce-force inch		

Appendix A – Embedded Toolbox Installation

Requirements for Alpha Controllers (Ethernet Connection):

- Javascript enabled browser Internet Explorer (IE) v6,v7
- Adobe Flash Player v9 or above
  - http://www.adobe.com
- QA1001 Alpha Controller Version 3.0 or above
- Q1001 Alpha Controller Version 4.0 or above

Connect to the controller using the IP address in the browser. Alpha controllers can also connect through the Controller Gateway using the serial port as described for the Q0001 Kappa controller.

Requirements for Alpha Controllers Using the Controller Gateway (Serial Connection):

- Microsoft Windows XP (for serial connection to a controller)
- Q0001 Kappa Controller v2.0 or above
- Javascript enabled browser and Adobe Flash Player described above

The Controller Gateway is a Windows based software program that provides a web based interface to an Alpha controller connected via a serial link.

Installing the Controller Gateway

Using the provided installation media, run the setup program and follow the on-screen instructions. During installation, TCP/IP ports for the web interface and the live event interface can be set. Leave the default values unless you understand their meaning and require a port change for your specific environment.

Running the Controller Gateway

The installer sets the Controller Gateway to automatically launch each time the computer is started. When Controller Gateway is running, a small icon appears on the system tray or Windows Task bar (typically at the bottom right corner of the screen).

Right clicking the Controller Gateway icon displays its menu. From the menu, select the Auto-Connect option. Note that Auto-Connect is the default option; this means that double-clicking the Controller Gateway icon also starts the auto-connection process.

The auto-connection process launches the default web browser and examines the computers available serial ports. The Controller Gateway looks port by port for a compatible Stanley controller connection. When one is found, the browser redirects to the controller's main menu. From the menu, setup, maintenance and analysis functions can be performed.

If a compatible controller is not found, the auto-connect mechanism offers to try again. If you choose to not try again, the browser is redirected to an "Offline Mode" menu. In offline mode, setups and configuration file exports can be created. These files can be imported to a connected controller in the future.

Appendix B – Torsion Compensation

Torsion Factor:

For all Stanley electric assembly tools, the angle information is based on the rotation of the resolver, which is directly attached to the rotor. This information is used for motor commutation, and it also serves as an angle encoder. The rotation of the tool output can be determined by dividing the rotor angle by the total gear ratio for the tool.

All things can deflect when loaded. Just as a long steel bar attached to a socket to produce high torque will deflect, likewise the gears within an assembly tool will deflect when subjected to the torque loads. In effect, the gears act as a torsion spring between the rotor and the socket, and it is the deflection of this spring that can give false angle data. In addition to the angular deflection within the gears of the tool, there can also be deflection of the parts of the joint.

Whenever this deflection is present in the tool or the joint or the tool mounting device, the angle information derived from the resolver will indicate a larger angle than the tool output actually rotates. This error is directly proportional to the torque level. That is, the deflection at 40 NM will be twice that at 20 NM.

In a torque vs. angle curve of a fastening cycle, at the end when the torque reaches its maximum value, the angle will also be at its maximum value. After shut off, as the torque falls to zero, the angle should remain at its maximum value. But in the typical torque vs. angle curve, as the torque falls to zero, the angle also appears to fall some amount. This is not because the fastener is being loosened. It is actually the resolver indicating that the angular deflection of the gears is relaxing to the neutral position. In this case, the maximum angle indicated at the maximum torque was incorrect. The resolver indicated more angle than the tool output actually rotated.

To correct for this slight error in angle data, the Alpha controller has a **Stanley-exclusive solution**. The Torsion Factor allows the user to input a value that compensates for the torsional spring rate of any part of the fastening system (the gears of the tool, the joint components, or the tool mounting device), and this factor is used to correct the angle reading throughout the fastening cycle. This factor is entered as **Degrees per NM**, and its default value is zero. If the default value is used, there will be no angular correction. If a value of 0.1 is used, each angle data point (every millisecond) will be modified by subtracting 0.1 times the torque value. For example, at 15 NM, the controller will subtract 1.5 degrees from the angle reading for that sample. At 30 NM, the controller will subtract three degrees for that sample.

The easiest way to determine the correct value for the Torsion Factor is to look at a torque vs. angle trace with Torsion Factor set to zero. The amount of degrees that the socket appears to loosen after the maximum torque, divided by that maximum torque is the Torsion Factor. For example, consider a torque vs. angle trace that indicates a maximum torque of 40 NM, and the maximum angle at this torque of 50 degrees. But the angle appears to loosen by four degrees as the torque drops to zero. The Torsion Factor can be determined by dividing four degrees by 40 NM to arrive at a Torsion Factor of 0.1 degrees per NM. When this value is entered into the Torsion Factor parameter, each angle reading will be corrected by this factor. When this factor is set correctly, any torque vs. angle trace will now indicate no apparent loosening of the fastener as the torque drops to zero after shut off; which is exactly as it should be.

Angle Validation:

Now that the angle can be indicated with great precision, the other challenge is to validate these results against a master torque/angle transducer with monitor. This is not as simple as setting both the controller and the monitor to the same snug torque and comparing the resulting angle.

It has been found that a tool's torque trace will never track **exactly** the same as the external. The calibration is only the average of a number of readings, generally at a high torque near the maximum capacity of the tool. When any individual torque reading from the tool's controller is

compared to a torque reading from the external torque monitor, it can easily have several percent differences higher or lower. This means that the tool's controller will start counting angle at a different point than the external torque/angle monitor starts counting. This could be five to 10 degrees different depending of the hardness of the joint.

The only way to get consistent results when validating an angle reading against an external monitor is to **pre-torque the joint slightly higher than the snug torque**. Run the tool on this already-tightened joint, with the snug torque set to the same value in both the controller and the monitor, even if the tool's transducer and the external transducer do not exactly agree near the snug torque, they will both start counting angle just before the fastener starts to rotate, so their zero angle will be synchronized exactly.

For example, if a brake line fitting requires six NM plus 40 degrees, pre-torque the joint to seven NM first. Then change to an Angle Control strategy, with six NM snug torque, plus 40 degrees angle target, and reset the external torque/angle monitor. Then as the tool is run in this angle control mode, the tool will start counting angle as soon as it has six NM (which might have been five or seven NM according to the external transducer), which is before the joint actually starts to rotate. And the external monitor will start counting angle as soon as it has six NM which is also before the joint starts to rotate. This way, both meters are reading angle from the same point, even though the torque readings may differ slightly because of the allowable tolerances in the torque calibration.

Warranty

Mechanical Products Limited Warranty:

STANLEY ASSEMBLY TECHNOLOGIES ("Stanley") warrants its Assembly Technologies mechanical products to the original purchaser to be free from deficiencies in material or workmanship for the useful life of the product.

Under this lifetime limited warranty Stanley will, at its discretion, repair or replace any product which, upon inspection, is acknowledged by Stanley to be defective.

This limited lifetime warranty shall apply to products which have been used under normal operating conditions for their intended use and shall not apply to products which have been subjected to: abnormal wear and tear, abuse, misuse, improper maintenance, negligence, continued use after partial failure, accident, alterations or repairs with non-genuine Stanley replacement parts.

Electronic Products Limited Warranty:

Stanley warrants its Assembly Technologies electronic products to the original purchaser to be free from deficiencies in material or workmanship for a period of one year after the date of shipment.

Under this limited warranty Stanley will, at its discretion, repair or replace any product which, upon inspection, is acknowledged by Stanley to be defective.

This warranty shall apply to products which have been used under normal operating conditions for their intended use and shall not apply to products which have been subjected to: abnormal wear and tear, neglect, component degradation, improper handling, overload, abuse, misuse, improper maintenance, use with improper accessories, or where alterations have been made.

Software Products Limited Warranty:

Stanley warrants its Assembly Technologies software products to the original purchaser to be free from deficiencies in material or workmanship for a period of one year after the date of shipment.

Under this limited warranty Stanley will, at its discretion, make available replacement software or an upgrade for any product which, upon inspection, is acknowledged by Stanley to be defective. Installation of the software shall be the responsibility of the requestor.

This warranty shall apply to products which have been used with specified, compatible hardware under normal operating conditions for their intended use and shall not apply to products which have been: modified, misused, improperly handled, improperly maintained, or used with non-compatible hardware or accessories.

OEM Products Limited Warranty:

Some Stanley Assembly Technologies custom engineered systems include components manufactured by others. The limited warranties of each individual manufacturer shall apply to these components and Stanley makes no representation or warranty of any kind, expressed or implied, with respect to such components.

General Terms:

This limited warranty gives you specific legal rights and is in lieu of all other warranties, expressed or implied, including the implied warranties of merchantability and fitness for a particular purpose. Some states and countries do not allow limitations on implied warranties, so the above may not apply to you. You may also have other rights which vary by state or country.

Stanley shall not be responsible for incidental or consequential damages or the inability to use its products for any purpose whatsoever. Stanley's maximum liability shall not in any case exceed the contract price for the products claimed to be defective. Some states and countries do not allow the exclusion or limitation of incidental or consequential damages, so this specific limitation or exclusion may not apply to you.

Specification Changes:

Stanley retains the right to discontinue and/or change specifications of any Assembly Technologies products without responsibility for incorporating changes in products already sold.

Warranty Claims:

To apply for warranty consideration, the original purchaser should take the following action:

Contact the Stanley Assembly Technologies customer service department to obtain a "Return Authorization Number" and "Warranty Claim Report Form."

Package the product including proof of purchase and the completed warranty claim form.

Note the Return Authorization Number on the exterior of the package and return freight to:

Stanley Assembly Technologies
5335 Avion Park Drive
Cleveland, Ohio 44143-2328

In the event that a product is repaired or replaced under the terms of the warranty, the warranty period of the repaired or replacement product shall be limited to the remaining portion of the original warranty period.

Product Services

Stanley provides full services for design, modification, service, repair, and training on Stanley products.

Contact **STANLEY ASSEMBLY TECHNOLOGIES** or their agents for information on training courses to aid users in becoming familiar with operations, maintenance, or programming of the Stanley DC electric tools and controllers.

No modification of Stanley tools and controllers can be made without the express permission of **STANLEY ASSEMBLY TECHNOLOGIES**. Refer all service to **STANLEY ASSEMBLY TECHNOLOGIES**, or their representatives.

Return Material Authorization (RMA) Procedures

A Return Material Authorization or RMA is required before returning any material for warranty or repair service.

- Contact **STANLEY ASSEMBLY TECHNOLOGIES** or their agents.
- Request Customer Service or Repair Services.

NOTE:
An RMA can be given without a purchase order. However, non-warranty repairs cannot be performed until a written purchase order or credit card authorization is received.

- Have the following information available for the person answering the telephone to obtain an RMA:
  - Company name and address.
  - A contact name and telephone number. If possible, have facsimile and pager numbers (if any) available.
  - The Stanley model number, serial number, and description for the item
  - A short description of the problem.

Contacts

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